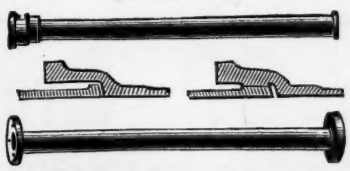
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXX. No. 1782.] LONDON, JULY 6, 1897. [49TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bonlea Foundry,

SOUTH STOCKTON-ON-TEES.

Formerly Springbank Iron-Works, Glasgow.

ESTABLISHED 1848.

ALSO MANUFACTURERS OF

SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

Telegrams: "BONLEA, STOCKTON-ON-TEES."

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL

AND GAS COALS.

Quotations and Analysis on Application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores, for Gas and Water Works.

WORKS:

ORMSIDE STREET, OLD KENT ROAD, LONDON.

'BEAR CREEK' CANNEL

LOG MOUNTAIN COAL, COKE, AND TIMBER CO.

PINEVILLE, KENTUCKY, U.S.A.

Cable Address:

"HULL, PINEVILLE." Codes used "ABC" & "A1."

Communications to the Company only.

HOUSE'S FIRE AND JOINTING CEMENTS

Write for List of Users. Before placing your Contracts, ask our Prices.

WE CAN QUOTE LOWER THAN ANY OTHER HOUSE IN THE TRADE FOR QUANTITIES.

HOUSE'S CEMENT COMPANY, Ltd., VAUXHALL ROAD, LIVERPOOL.

HENRY BALFOUR & CO., LD.,

London:
47, VICTORIA ST., S.W.
Mr. HENRY PUPLETT, A.M.S.E.

LEVEN, FIFESHIRE.
ESTABLISHED 1814.

Telegrams:
"FOUNDRY, LEVEN, FIFE."

Makers of all Classes of

GAS-WORKS PLANT, COAL & COKE SCREENING & ELEVATING MACHINERY, COKE-CONVEYORS, &c.

GASHOLDERS with STEEL and CAST-IRON TANKS, IRON ROOFS, and BUILDINGS.

FOUR-WAY VALVES.

EXHAUSTING MACHINERY.

OLDEST MAKERS OF ROTARY EXHAUSTERS.

WALLER'S PATENT 4 & 3 BLADE EXHAUSTERS

(Three Blade under 40,000 per Hour)

Use LESS Steam and give a STEADIER Gauge than any other type of Exhauster.

EXHAUSTERS CONVERTED TO OUR PATENT TYPE

Give 30 to 40 per cent. increased Capacity with the SAME Power and at the SAME Speed.

OVER 350 IN USE.

OLDEST MAKERS OF THE BEALE EXHAUSTER FOR 400 WORKS.

PATENT WASHER-SCRUBBERS, WITH WOOD CLUSTERS.

GAS-VALVES, GOVERNORS, STEAM-REGULATORS, COKE-BREAKERS.

CATALOGUES, PLANS, SPECIFICATIONS, AND ESTIMATES ON APPLICATION.

GEORGE WALLER & CO., 165, Queen Victoria Street, E.C.; and Stroud, Gloucestershire.

SAWER & PURVES, Garratt St. Works, MANCHESTER,

MANUFACTURERS OF

IMPROVED WET GAS-METERS IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

IMPROVED DRY GAS-METERS.

Speciality: PATENT CASH PREPAYMENT METERS.

CATALOGUE SENT ON APPLICATION.

D. HULETT & CO., LTD.

55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

WROUGHT-IRON TUBES & FITTINGS.

STREET LAMPS & POSTS.

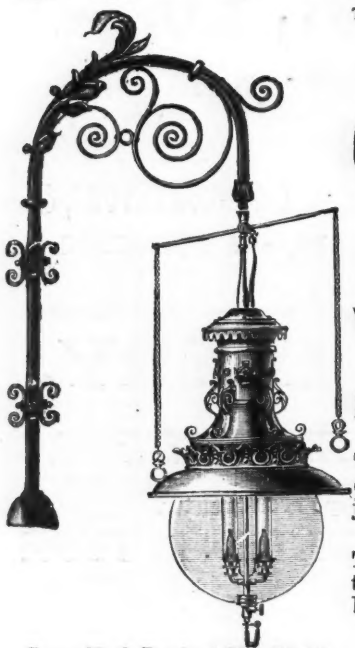
PRICE LISTS ON APPLICATION.

FALK, STADELMANN, & CO., LD.,

VERITAS LAMP WORKS,

83, 85, & 87, FARRINGDON ROAD, LONDON, E.C.

Telegraphic Address: "Lamps, London." Telephone No. 6707.



Swan Neck Pendant **No. 42,281** with Lantern **No. 42,271.**

THE "VERITAS" GAS ARC LANTERNS

(PROTECTED BY ROYAL LETTERS PATENT)

SPECIALLY CONSTRUCTED FOR THE

Incandescent System of Gas Lighting.

Wind, Rain, and Dust Proof.

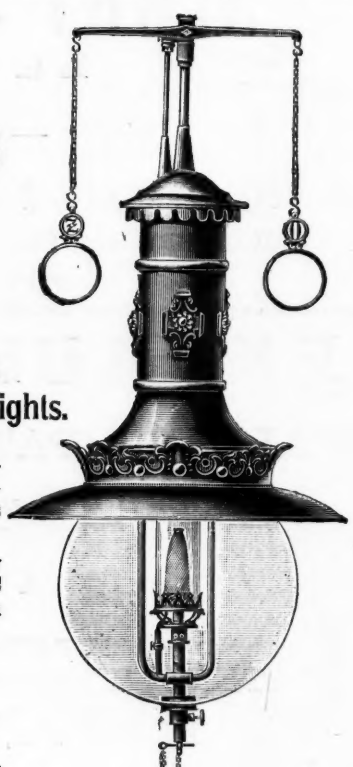
Enamelled Steel throughout.

Made for One, Two, Three, and Five Lights.

The undisputed great advantages of the **Incandescent System of Gas Lighting** are frequently prejudiced by atmospheric influences upon the Mantles or by sudden gusts of wind.

These deficiencies have been entirely overcome by the construction of our "VERITAS" GAS ARC LANTERN, which differs from others, and which we are confident is the best yet offered.

Each Lantern complete; nothing to get out of order; and no skill is required in fixing.



No. 42,265.

Managers of Gas Companies will do well to apply for Descriptive Catalogue GRATIS.

(Wholesale only.)

THE BARROWFIELD IRON-WORKS, LIMITED,

Late LAIDLAW, SONS, & CAINE, Limited,

GAS ENGINEERS AND CONTRACTORS,

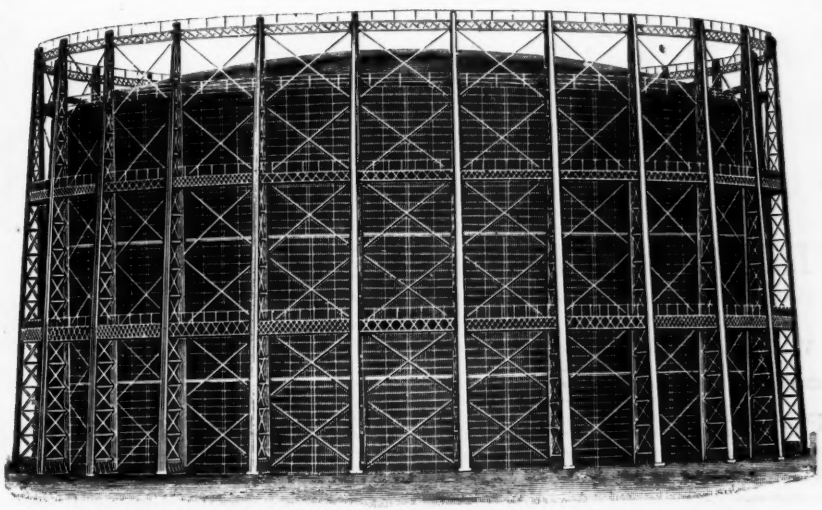
Telegrams: "GASOMETER GLASGOW." GLASGOW.

GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS.



OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.

THREE-LIFT GASHOLDER. Capacity, SIX MILLION cubic feet.
240 feet Diameter by 45 feet Deep each Lift. Erected at Glasgow, 1893.

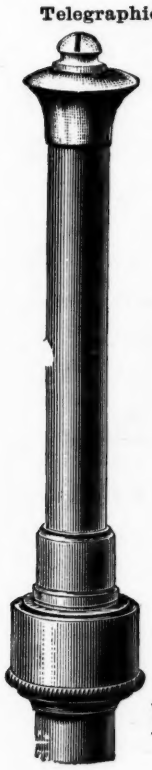
London Office: 6, LITTLE BUSH LANE, CANNON STREET.

GEORGE ORME & CO.,

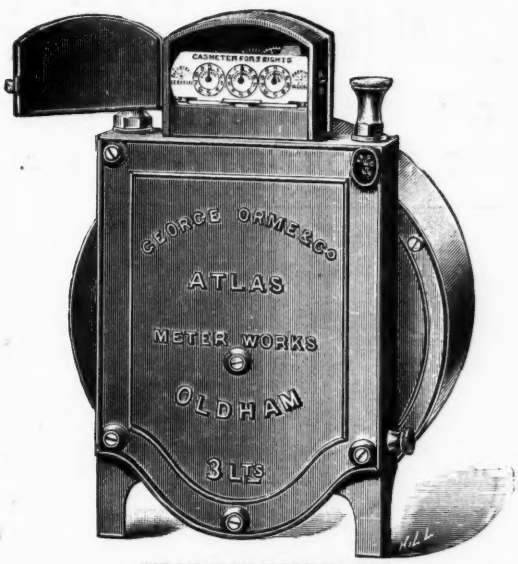
MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS,

ATLAS METER WORKS, OLDHAM.

Telegraphic Address: "ORME OLDHAM." National Telephone No. 93, OLDHAM.



No. 200.



WET GAS-METER IN CAST-IRON CASE.

DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR FOR STREET LAMPS.

AS ILLUSTRATION NO. 200.

Adopted by the leading London and Provincial Gas Companies. More than 150,000 now in use.

Main Gas Cocks, Pressure-Gauges, & all descriptions of Gas, Water, & Steam Fittings in stock.

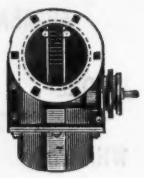
Illustrated Price Lists and full Particulars on application.

NEWTON, CHAMBERS, & CO., LIMITED,

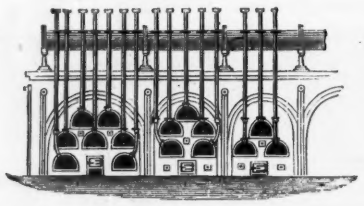
THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

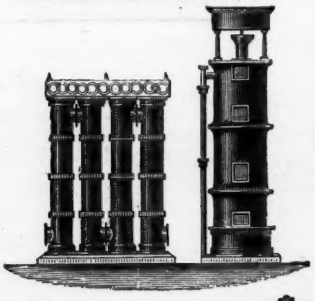
SLIDE VALVES,
WITH RACK & PINION
OR
Internal or External
SCREWS of all sizes.
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates,
Tools, &c.

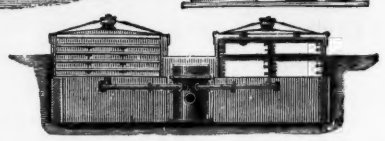


WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE-VALVES
for working Purifiers,
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS, and SPECIALS.
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

Wrought-Iron

And Fittings and Accessories.

LAMBERT BROS., WALSALL,

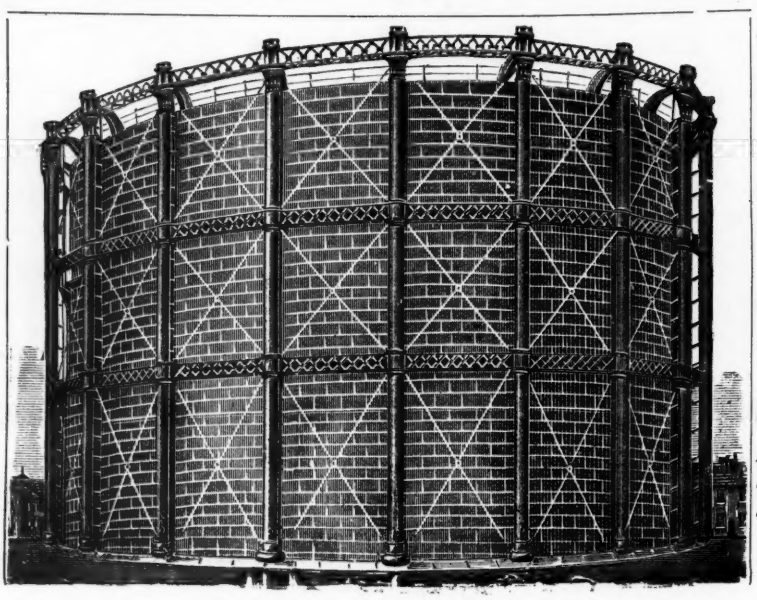
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Ltd., Short St., LAMBETH.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF **GASHOLDERS & GAS PLANT,**

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES,
PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF
STRUCTURAL IRON
AND STEEL WORK.
BRIDGES,
ROOFS,
PIERS, ETC.



WORKS AND HEAD OFFICE:
TIPTON,
STAFFORDSHIRE.

LONDON OFFICE:
11, VICTORIA ST.
WESTMINSTER.

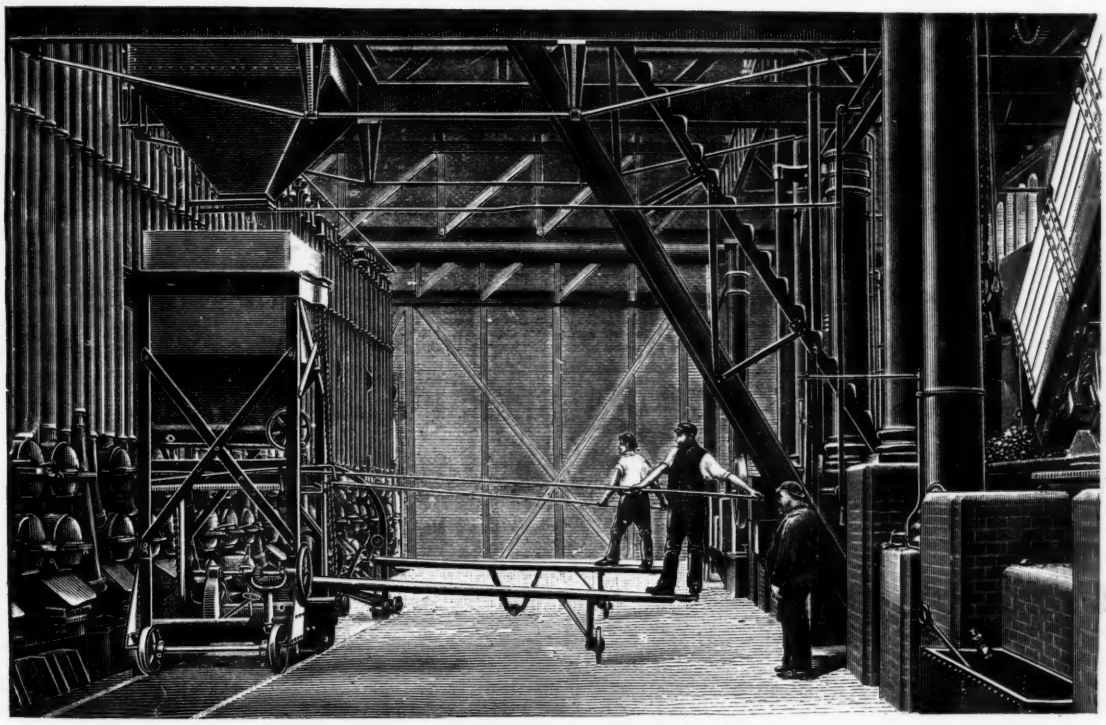
TELEGRAPHIC ADDRESSES:
"HORSELEY, TIPTON."
"GALILEO, LONDON."

WEST'S GAS IMPROVEMENT CO., LTD.

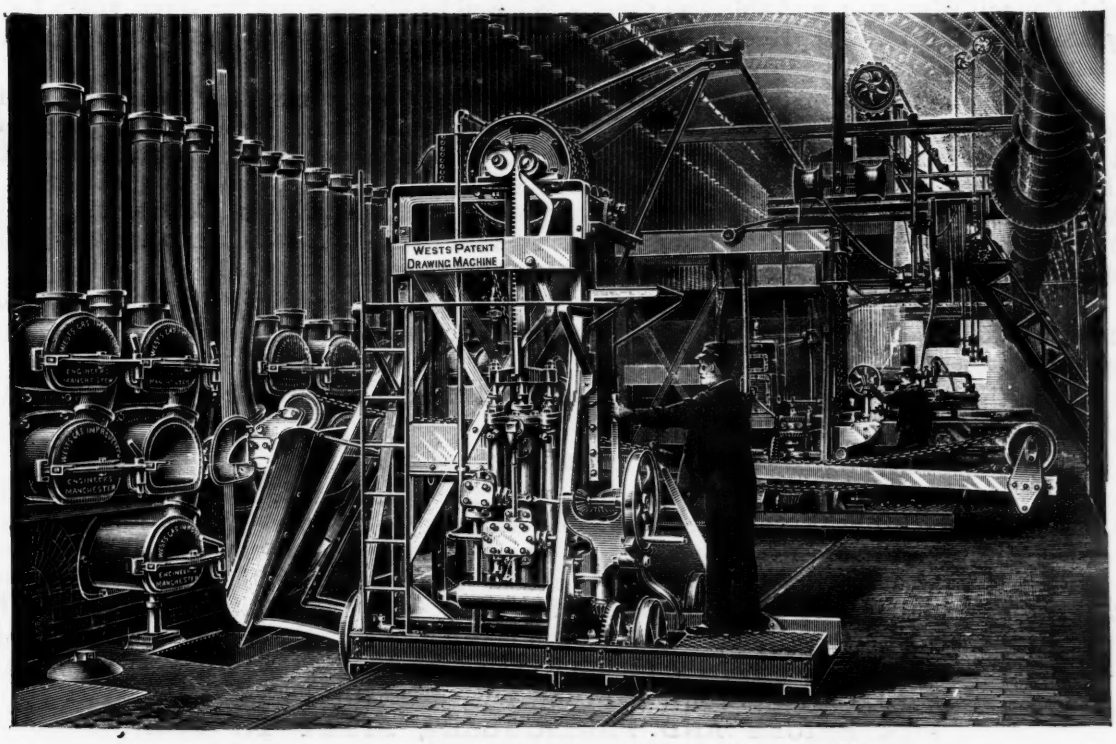
ALBION IRON-WORKS, MILES PLATTING,

MANCHESTER;

And 104, Queen Victoria Street, London, E.C.



West's Manual Charging and Drawing Machines.



West's Compressed-Air Drawing and Charging Machines.

Contractors for

WEST'S REGENERATOR SETTINGS & RETORT-HOUSE PLANT.

IMPROVEMENTS IN STREET LIGHTING.

Highest Efficiency with Greatest Economy.

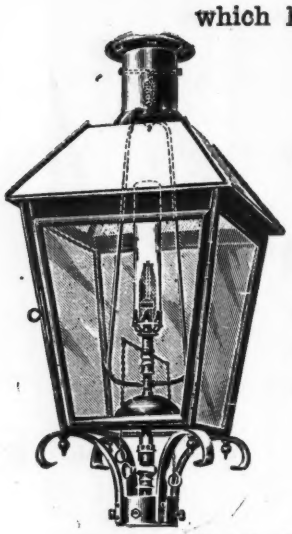
LIGHTING AUTHORITIES, GAS ENGINEERS, and GAS MANAGERS

are invited to inspect the

INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of

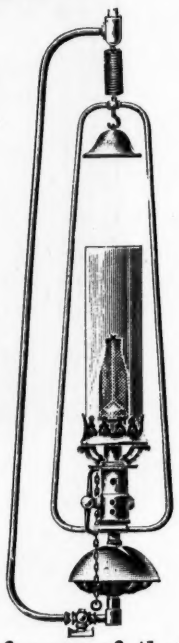


STREET LIGHTING,

the difficulties caused by VIBRATION having been OVERCOME by the use of the

NEW SPRING SUSPENSION FRAME (Patent).

This System of Lighting meets the requirements of all Lighting Authorities in those Districts where it is desired to effect an Improvement in Street Lighting WITHOUT INCREASE OF EXPENDITURE.



The following are Extracts from a PAPER read by Mr. F. G. DEXTER, before the SOUTHERN DISTRICT ASSOCIATION.

"The success of the experimental (Welsbach) lighting secured the contract for one of the Parish Council Districts; and this was shortly followed by the contract for three years for the city lamps. The total represents altogether about 500 single lamps, and 15 refuge lamps containing two lights."

"In the matter of maintenance of the street lights, the record is favourable—in fact, more so than the estimate provided. By the test-meter, the average daily consumption works out to 38 cubic feet per light, including bye-pass. The bye-pass consumes with a flame half an inch long, $\frac{1}{5}$ foot per hour. This represents 1000 cubic feet per lamp per annum. The average consumption per light, when in use, works out to 12,900 feet per annum, or about $3\frac{2}{5}$ feet per light per hour. The lighting is continued all the year round, from the average times of one hour after sunset to one hour before sunrise."

"The mantles have worked out to an average of three per lamp per annum; but, bearing in mind the absence of frost last winter, the writer believes that four mantles per light is more likely to represent average conditions."

"In the matter of cleaning, it may be said that the lanterns require less attention than with the ordinary flat-flame burner."

"The number of lights attended to per man averages 85."

"The 'Welsbach' Light is undoubtedly one of the greatest aids to successful competition that the Gas Industry has ever experienced. Its influence, while reducing the relative cost of light, has advanced the consumption of gas all over the country by the increased satisfaction of the existing consumers, and the attraction of others. The writer feels that its influence should not be confined to the house. It is capable of meeting every competitor in the street, from cheap oils to arc lights, in cost and in effect; and it is hoped that the foregoing experience may lead many others to seek its aid and to realize its efficiency."

FOR PRICES AND PARTICULARS, APPLY TO THE

INCANDESCENT GAS-LIGHT CO., Ltd.,

Palmer Street, Westminster, London.

THE "TRAFALGAR"
PREPAYMENT GAS-METER
FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
3. Impossibility of being tampered with.
4. Unaffected by irregularities in shape or thickness of the penny.
5. Can be fixed to any ordinary Wet or Dry Meter.
6. Extra large Money-Box.
7. Price Changer can be altered without otherwise disturbing the Meter.
8. Index showing number of pennies in the mechanism at any time.
9. Rejection of half-pennies certain.

GUARANTEED FOR FIVE YEARS.

FRANK WRIGHT'S PREPAYMENT GAS-METER CORPORATION, Limited,

Telegraphic Address: "Gasometer, London." | Manufacturers of Wet and Dry Gas-Meters. Offices and Works: 62, GLENGALL ROAD, S.E. | Telephone No. 59 Peckham.

TELEGRAMS: "FIRECLAY," LEEDS.
TELEPHONE No. 612.

BRANDS: CLIFFS', INGHAMS', BROOKES'.

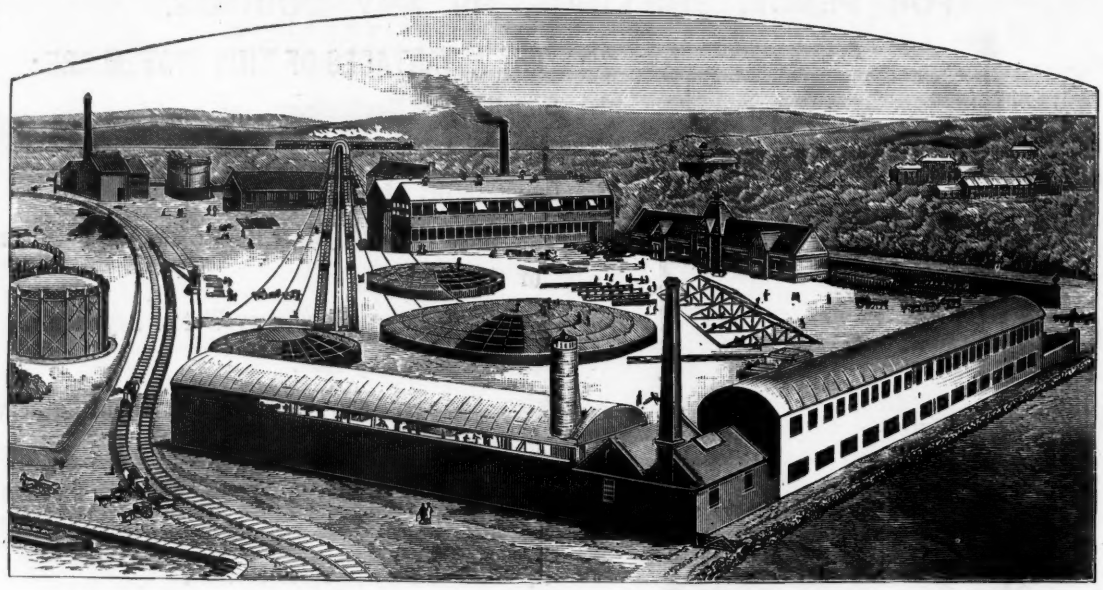
The Leeds Fireclay Co. Ltd
WORTLEY, LEEDS.
ENGINEERING DEPARTMENT.

CONTRACTORS for
BUILDINGS, ROOFS,
RETORT SETTINGS & IRONWORK
COAL AND COKE
BREAKING, ELEVATING, CONVEYING,
AND STORAGE PLANT.
RE-SETTING EXISTING RETORTS.
RETORT HOUSE WORK GENERALLY

MANUFACTURERS of
HORIZONTAL & INCLINED
MACHINE AND HAND-MADE
RETORTS,
BRICKS, BLOCKS, TILES, &c.

WILLEY & CO., GAS ENGINEERS.

OFFICES: EXETER. WORKS: 248, Kingsland Road, LONDON; James St., and St. Thomas, EXETER.



MANUFACTURERS OF WATER-GAS PLANT, GASHOLDERS, GAS-FITTINGS, GAS APPARATUS, WET AND DRY CONSUMERS' METERS, AUTOMATIC METERS—PENNY-IN-THE-SLOT.

CONTRACTORS TO THE GOVERNMENT.

Telephone 132. Telegraphic Address: "WILLEY, EXETER."

LARGEST MANUFACTURERS IN THE UNITED KINGDOM OF GAS-RETORTS,

HORIZONTAL or INCLINED; also Makers of SEGMENTAL RETORTS of all SECTIONS.

PATENTEES OF
MACHINE-FLANGED RETORTS

B. GIBBONS, JUNR., LTD.,

TELEPHONE No. 8010.

DIBDALE WORKS DUDLEY.

Telegraphic Address: "MACHINE, LOWER GORNAL"

SPECIAL BRICKS and BLOCKS of every description for GENERATOR and REGENERATOR FURNACES.

"ABC" Code and UNICODE used for Telegrams and Cablegrams.

Large Stocks of Bricks of all sizes, Burrs, Boiler Seating Blocks and Covers, Plain and Rebated Tiles, &c., &c.

RETORTS and other FIRE-CLAY GOODS CAREFULLY PACKED for EXPORT.

FOREIGN and HOME COPIES of ILLUSTRATED CATALOGUES on Application.

The 'SUNLIGHT' INCANDESCENT GAS-BURNER

COMBINES HIGH ILLUMINATING POWER and GREAT ECONOMY OF GAS with a SOFT, PLEASANT LIGHT.

THE NEAREST APPROACH TO SUNLIGHT.

THE IDEAL LIGHT FOR DOMESTIC USE.

Price from **5/3** Complete.

"COSMO" BURNERS Complete, as shown, 12-inch Shade, 7/9 each. Price List and Terms on Application.

THE NEW INCANDESCENT (Sunlight Patent) GAS LIGHTING CO., Ltd., 33 & 34, Shoe Lane, LONDON, E.C.

S. CUTLER AND SONS, MILLWALL, LONDON.

CARBURETTED WATER-GAS PLANT.

(CUTLER'S PATENTS)

ADOPTED AT HORNSEY, HASTINGS, SOUTHEND,

PLYMOUTH, BUENOS AYRES, SOUTHALL (BRENTFORD GAS COMPANY).

GASHOLDERS

OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING FOR GASHOLDERS

HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

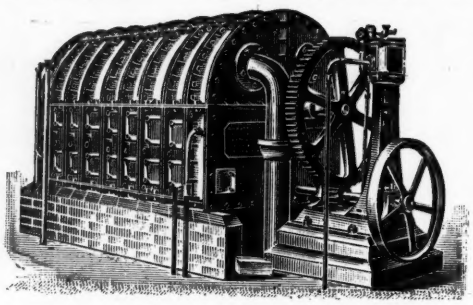
IT IS STRONG AND CHEAP, AND REQUIRES NO PIERS FOR ITS SUPPORT.

KIRKHAM, HULETT, & CHANDLER, Ld.

3 & 4, PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.

PATENT "STANDARD" WASHER-SCRUBBER.

This Apparatus upholds its title, the "STANDARD"; being recognized by leading Engineers as the most efficient Apparatus for the Extraction of Ammonia from Coal or other Gases.



The Largest Order ever given for WASHER-SCRUBBERS was recently received being for **16** Patent "Standard" Washer-Scrubbers, each for 3,500,000 Cubic Feet of Gas per day.

Number of Patent "STANDARD" Washer-Scrubbers in use at this date

540

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland District Office: PRINCE'S CHAMBERS, 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.

TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.

TELEGRAPHIC ADDRESS: "PARKER LONDON."

R. LAIDLAW & SON

ENGINEERS & IRONFOUNDERS.

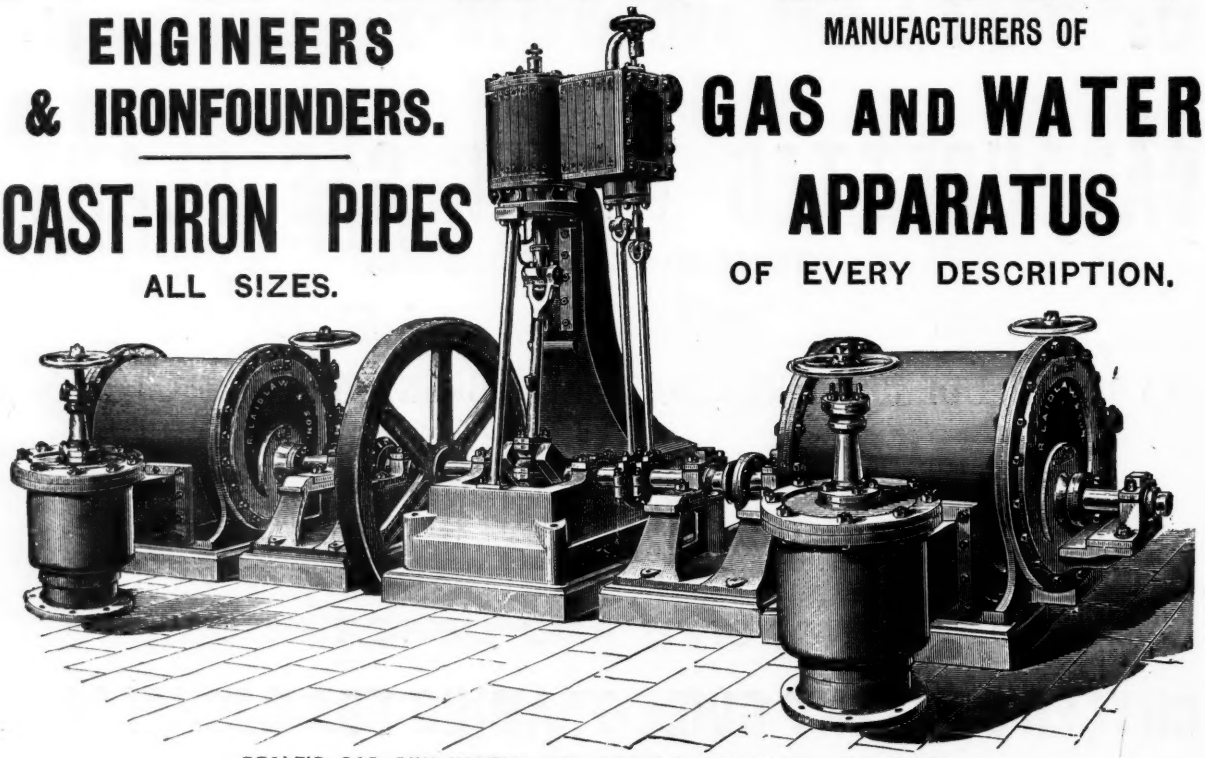
MANUFACTURERS OF

GAS AND WATER APPARATUS

OF EVERY DESCRIPTION.

CAST-IRON PIPES

ALL SIZES.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED—ALL SIZES.

ALLIANCE FOUNDRY GLASGOW. | SIMON SQUARE WORKS, EDINBURGH. | 6, LITTLE BUSH LANE, LONDON, E.C.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

SINCE 1893

MESSRS. HUMPHREYS & GLASGOW

Have constructed or have in hand

CARBURETTED WATER-GAS PLANT

FOR THE FOLLOWING UNDERTAKINGS:—

	Cub. Ft. Daily.		Cub. Ft. Daily.
Copenhagen	700,000	Norwich	1,000,000
Belfast	1,700,000	Winchester	200,000
Belfast (Second Contract)	4,500,000	Holyoke, Mass.	600,000
Glasgow	300,000	Hoylake	125,000
Brussels	700,000	Shanghai	225,000
Brussels (Second Contract)	700,000	Stockport	500,000
Liverpool	3,500,000	St. Joseph, Mo.	750,000
Tottenham	750,000	Lea Bridge	350,000
Tottenham (Second Contract)	750,000	Lea Bridge (Second Contract)	350,000
Santiago	400,000	Guildford	350,000
Swansea	750,000	Stockton-on-Tees	500,000
Manchester	3,000,000	Syracuse, N.Y.	850,000
Brighton	1,750,000	Brentford	1,200,000
Preston	1,500,000	Commercial Gas Co.	850,000
New York	1,200,000	Commercial Gas Co. (Second Contract)	850,000
Southport	750,000	Bridlington	125,000
Bath	1,000,000	Middlesbrough	1,250,000
Newburgh, N.Y.	350,000	Croydon	1,250,000
Newburgh, N.Y. (Second Contract)	250,000	L. & N.W. Railway, Crewe	700,000
Edinburgh	2,000,000	Taunton	225,000
Coventry	600,000	Rotterdam	850,000
Coventry (Second Contract)	600,000	Dorking	125,000
Bordentown, N.J.	125,000		

THE GASLIGHT AND COKE CO. { Nine Elms / Bromley } . . . . . 6,250,000 Cubic Feet.

In addition to which the 1891 Installations of The Gaslight and Coke Company, on the Humphreys' Double-Superheater System, have a capacity of 12,000,000 Cubic Feet per diem.

IN THE UNITED STATES,

223 Sets of Humphreys' Double-Superheater Apparatus have been erected by The United Gas Improvement Company alone; **102** of these since **1893**. This Company (of which Mr. A. C. Humphreys was formerly Chief Engineer) was, until lately, the largest Constructor of Carburetted Water-Gas Apparatus in the World.

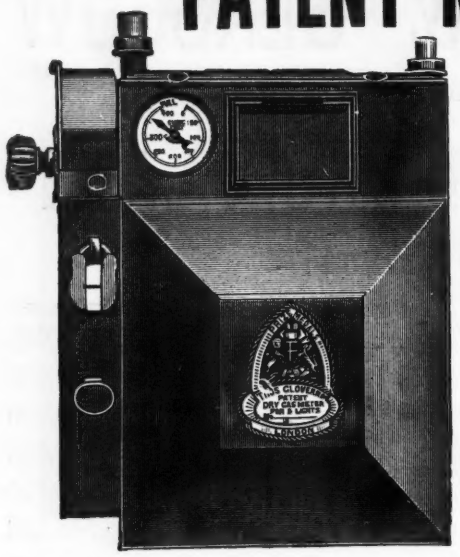
At the present time, Messrs. Humphreys and Glasgow hold that position.

9, VICTORIA STREET, LONDON, S.W.
Telegrams: "EPISTOLARY, LONDON."

UNITED STATES OFFICE:
BANK OF COMMERCE BUILDING, NEW YORK.

THOMAS GLOVER & CO.'S

PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 28, BATH STREET. *Telegraphic Address: "GOTHIC."*

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address: "GOTHIC."*

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."*

W. PARKINSON & CO.

SQUARE STATION METERS.

All the Meters (which number 14) at the Beckton Station of THE GASLIGHT AND COKE COMPANY have been erected by the above Firm.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

CONTENTS.

EDITORIAL NOTES:— PAGE

GAS, LIGHTING, &c.—
The Failure of Fuel-Gas Distribution in the United States . . . 13
The Mining Interest and the Workmen's Compensation Bill . . 14
Trouble in the Engineering Trade 14
Loss of the St. Anne's-on-the-Sea Bill 15

WATER AND SANITARY AFFAIRS—
The Second Reading of the Metropolitan Water Companies Bill . 15
The Debate on the Southwark and Vauxhall Water Bill 15
London County Council and Water Supply in the Outside Areas . 16

THE INCORPORATED GAS INSTITUTE—

ANNUAL MEETING IN BATH—
Naphthalene in Modern Gas Manufacture, and the Carburetting of Illuminating Gas. By W. Young, of Peebles, and T. Glover, of West Bromwich 16
Three Years' Use of Carburine as an Enricher. By J. Davis, of Gravesend 19
The Automatic Regulation of Pressure in the Distributing Mains. By W. R. Chester, of Nottingham 26

ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market 33
Electric Lighting Memoranda 33
John Orwell Phillips 34
Parliament on the Registration of Plumbers 35
Mr. F. Egner on Inclined Retorts in Europe 36

TECHNICAL RECORD:—
The Improved Denayrouze Burner 38
Shale Distillation and the Production of Sulphate of Ammonia . 38

REGISTER OF PATENTS:—
Making Producer and Water Gas—Whitfield, C. 39
Generating and Storing Acetylene Gas—Thorn, F. S., and Hoddle, C. 39
Manufacture of Heating Gas—Wise, W. L. (Thomson, E.) . . . 39
Self-Igniting Incandescence Bodies for Gas-Burners—Nicholls, W. 40
Incandescent Gas-Burners—Clarke, A. 40
Ascension-Pipes—Meek, T. J., Davison, H., and Southam, J. . . 40
Automatically Lighting and Extinguishing Gas-Burners—Lenze, P. 40
Incandescent Gas-Burners—Mayer, D. 40
Coke-Breaker—Valon, W. A. M'I. 41
Photometer for Automatically Measuring and Registering the Intensity of the Light of a Gas-Flame—Cowan, W. and B., Ltd. (Martenson, C. V. L.) 41
Patent Notices 41

CORRESPONDENCE:—
Automatic Regulation of Pressure—Naphthalene—The Spiral-Guided Gasholder at Chester—Water Finders' Work and Fees . 42

PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills 43
House of Commons—
Metropolitan Water Companies Bill 43
Progress of Bills 44
House of Commons Committee—East London Water Bill . . . 44

LEGAL INTELLIGENCE:—
High Court of Justice—
Queen's Bench Division—Grand Junction Water Co. *v.* Davies . 46
Official Referees Court—Ward *v.* Plymouth Gas Company . . 47
Bow County Court—Prosecution of the Commercial Gas Company under the Alkali Act 51
The Incandescent Gas-Light Company's Patents 56
Conviction of a Gas Collector for Embezzlement 56

MISCELLANEOUS:—
Edinburgh and Leith Gas Commissioners 57
Manchester Gas Supply—Annual Report of the Gas Committee . 58
Bury Gas Supply—An Explanation of the Lessened Profits . . . 59
Birmingham Corporation Water Department—The Annual Accounts 59
Notes from Scotland 60
Gas and Water Companies' Stock and Share List 61
Current Sales of Gas Products 62
Coal Trade Reports 63

PARAGRAPHS:—
OBITUARY: Mr. J. W. Longbottom; Mr. W. Edmonds, J.P. . . 37
PERSONAL: Dr. Percy F. Frankland, F.R.S.; Mr. A. E. Walker; Mr. Harold Woodall; Mr. W. M. Gale; Mr. Peter Watson; Mr. J. Foster; Mr. Dunn, M.Inst.Mech.E.; Mr. Arthur Andrew; Mr. G. J. Symons, F.R.S.; Mr. J. D. Smith 37
The London County Council and the Water Undertakings . . . 16
A Large Irrigation Reservoir 33
Acetylene Regulations in Switzerland—Will Free Wiring Pay?—The Chemical Composition and Strength of Steel 37
Iron and Steel Institute—Carbide of Calcium as an Insecticide—Society of Chemical Industry—A Close Estimate of the Yield of a Watershed—Completion of the New Reservoirs of the East London Water Company 39
Driffield Gas-Works Purchase 41
Additional Capital for the Dorking Gas Company—The Proposed Purchase of the Budleigh Salterton Gas-Works 42
Reductions in Price—Newbury District Water Company . . . 56
Increased Consumption of Gas in Bradford—Water-Works Improvements at Hull—Gas Coal Contracts for Leeds—The Accident to the Rope-Guided Holder at Middlesbrough—Sales of Stock . . 60
Increase of Price by the South Metropolitan Gas Company—The Public Lighting of Leeds 63
English Incandescent Gas Share Company, Limited—Gas Devices for Illuminations—Electric Lighting Extensions at Leicester—New Gas-Works for Bramham (Yorks.)—The Price of Gas in Manchester Out-Districts—East Surrey Water Company . . . 64
The New Water-Works for Barnsley—Dissension in the Conway and Colwyn Bay Water Board—St. Helens Water Supply . . 65

TO SUBSCRIBERS.

TERMS OF SUBSCRIPTION TO THE "JOURNAL":

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance.

If credit is taken, the charge is 25s. a year

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Second Half of the Year, are reminded that this can only be done during the current month.

All communications, remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

EDITORIAL NOTES.

The Failure of Fuel-Gas Distribution in the United States. LAST week there appeared in the "JOURNAL" a condensed report of an important and interesting paper read by Mr. F. H. Shelton before the Western Gas Association of the United States. It recounted, more fully and fairly than any previous communication had attempted, the disastrous experience of those promoters of fuel-gas enterprises who have from time to time tried in different localities in the States to establish a business of a nature that is occasionally talked about in this country as a possible alternative to, or even a development of, the coal-gas industry. One not infrequently hears the observation that the employment of gas for fuel and power purposes is making such strides alongside the increasing use of electricity for lighting, that the time will come when British gas undertakings will find it expedient to confine their attention to the former field, and leave domestic and street lighting to the electricians. Of course, gas experts know much better than this; but they are a silent army in comparison with their critics and would-be advisers, who engage the public ear so easily with "mechanical romances." Moreover, when certain adroit traders upon popular ignorance of such matters talk at random about the possibility of the existing gas undertakings distributing cheap gas for fuel purposes, it is not easy to demonstrate to anybody but an expert the impracticability and worthlessness of the suggestion; and the experts do not require this proof. Mr. Shelton has done good great service to the gas industry by bringing together the evidence that exists, apart from expert opinion, to show that "fuel gas as a whole, in every case where "tried, has been a flat and total failure." The facts cannot be disputed; and they are certainly worth knowing even by those who do not need them to confirm their instructed judgment.

The United States have afforded virgin ground for all manner of experiments; and in no department of human enterprise have these been more persistently tried than in the matter of gas supply. Fuel gas, as Mr. Shelton has pointed out, has been put upon the market in the United States for various objects besides that of testing its commercial value. But wherever this has been genuinely attempted, the result has been total failure. This conclusion does not refer to manufacturers' private operations, but applies solely to the known "instances where a so-"called cheap and non-luminous manufactured gas has "been distributed to the public for general use as a so-"called 'fuel gas' to replace coal or other combustibles used "for heating, cooking, power, and other purposes." The first example mentioned by Mr. Shelton is the case of the town of Yonkers, New York, where a Company started works in 1880 to exploit the so-called "Strong" fuel-gas process. Though it was intended to be a show plant to enable the proprietors to deal in their patent rights, the works tried to do a genuine fuel-gas business in what was one of the most thriving manufacturing and residential cities in the country, having a population of 32,000. The Company never obtained more than 55 customers; and after selling 30 million cubic feet of gas of about 310 to 365 units strength—say, one-half the calorific value of ordinary coal gas—at a quarter of the existing Gas Company's price for illuminating gas, the concern passed into liquidation. The experiment was not repeated with "Strong" gas. The next place to try fuel gas was the larger town of Lynn, Massachusetts. Lowe uncarburetted water gas was distributed, and at first obtained a ready sale at prices from 30c. to 50c. per 1000 cubic feet. After a short experience, the public would not have the commodity at any price, because it did not do the work expected of it; while the Company supplying illuminating gas in the same town, and selling it at from three to six times the price, were increasing their consumption 14 per cent. per annum. Eventually, a merciful fire stopped the competition.

It is quite unnecessary to repeat more of Mr. Shelton's instances. He shows that some fuel-gas schemes died a natural death; others saved themselves from financial disaster by changing to illuminating gas; and yet others were swindles from the first. His story contains some racy reading. He summarizes the evidence in the statement that in the last sixteen years twenty-seven trials of fuel-gas undertakings have actually been made. "Of these, "twenty-two have utterly collapsed. Of the other five,

" two (Bridgeport and Rapid City) are trying to get out of " the fuel-gas business; and three (Framingham, Cottage " City, and Tacony), after six years' operation each, now " show less output or fewer customers than before, and " never a dollar of earnings returned to stockholders from " commercial fuel-gas sales." There was an animated discussion upon the paper; but as a good deal of what was said related to the speakers' personal experiences of competing schemes, we do not reproduce it. Suffice it to state that Mr. Shelton's position was left intact; and he received the highest compliment the meeting could pay him on his work—a "rising vote" of thanks.

The Mining Interest and the Workmen's Compensation Bill.

It may fairly be presumed that the deputation of members of the Mining Association of Great Britain to the Prime Minister on Friday was the last protest of any importance that will be made from outside Parliament against the Workmen's Compensation Bill. It was desirable that this proceeding should be taken, because the newspapers have been full of the complaints of the mining interest against the Bill, which certainly touches this industry more than any other. Coal mining is not the most dangerous employment in the world; but it partakes with seafaring in the wholesale character of those casualties which occasionally overwhelm the workers. It is obvious that the case of a colliery owner confronted with the liability to compensate some hundreds of sufferers at once under the provisions of the Bill, differs from that of an employer of any other description of labour; and it was well that this case, in all its bearings, should be put before the Government, who have taken the responsibility for the measure. The gravity of the occasion was illustrated by the fact that the deputation was received by Lord Salisbury, the Home Secretary, and Mr. Chamberlain together, all of whom spoke in reply to the representations laid before them. It was a great emergency; but it was met in the only way possible in the circumstances. The Home Secretary declared at the commencement of his speech that if the Administration had shared the gloomy anticipations expressed with regard to the operation of the Bill by the representatives of the coal trade and the allied industries, they would never have brought it forward. This is the proper answer to all objections of the kind; because it is not to be supposed that any Government would enter upon a vast and far-reaching scheme of industrial reform without carefully counting the cost. Mr. Chamberlain told the deputation that the only possible course open to all parties is to accept the principle of the Bill, and try to make it as perfect as possible. In this spirit he criticized the representations of the speakers, whom he endeavoured to meet on their own ground. It having been objected that the proposed scale of compensation is excessive, Mr. Chamberlain pointed out that this complaint originated in the idea, which he declared to be unfounded, that the maximum amount of compensation would in all cases be awarded. Then, with regard to the cost of compensation for disasters on a large scale, Mr. Chamberlain admitted that the amount would be considerable, and suggested that the solution of the difficulty will be found in a mutual insurance fund.

It seems to have been the idea of most of the members of the deputation that employers will have to work the Act as well as satisfy its provisions; but it is the view of the Government that the workmen themselves will be brought into line with the employers in this respect. Herein lies the best promise of the Bill; and this at the same time distinguishes the present scheme from that of Mr. Asquith, which proceeded upon the assumption that the interests of employers and employed must always be in opposition to each other. Lord Salisbury had little to say to the deputation after the addresses of the Home Secretary and Mr. Chamberlain; but what he did say was instinct with the spirit of statesmanship. He observed that when it is sought to leave one set of conditions and enter upon another, some difficulties are invariably found. " There are always hard cases which have vested interests " to adjust, expectations to meet, new conditions to satisfy." When the hand has once been set to the plough, however, there must be no looking back. The Workmen's Compensation Bill is going to pass this session; and the best course for employers to follow is to accept the inevitable, and see how the new order of things is likely to affect them and those with whom they have relations likely to be altered by it.

Trouble in the Engineering Trade.

A good deal was said and written during the past week concerning the prospects of a great strike or lock-out in the engineering trade over the question of an eight-hour day for the London district. The question is one that was certain to arise sooner or later; so that its entry upon the acute stage now, or at some future time, is a mere matter of the policy of those who control the labour interests of the trade. The grant of an eight-hour day, without reduction of pay, by the Government at the Royal Arsenals in 1893, and afterwards by other large employers of engineering labour such as the Thames Iron-Works and the Ship Repairers' Association of the Port of London, was of necessity the introduction of the "thin end of the wedge" into the solid phalanx of the employers. Early in May, the first attempt to drive the wedge home was made in the form of a demand put forward in a circular-letter addressed to the employers in the names of the Amalgamated Engineers, the Boiler Makers, the Steam-Engine Makers, the Hammermen, the London Coppersmiths, the London Drillers, and the United Machine Workers' Societies. This letter pointed out that the eight-hour day, without reduction of pay, having been granted by some firms, including the Government, the time had come, in the opinion of the men, for an extension of the arrangement. An answer was requested by May 26. The employers' reply to this communication was that the time appointed for their decision was too short. The Joint Committee of the Trade Unions, having once got into action, did not remain content with the first move, but on May 28 made a further communication to the employers, to the effect that the men would cease working overtime after that date. On June 5 the federated employers met at Carlisle; and though it was stated that in the interim a number of London shops (mostly small) had conceded the eight-hour day, the result of the meeting was a notification to the men's Committee that their request could not be granted. At the same time, the employers demanded the withdrawal of the notice about the stoppage of overtime. On the latter point the Committee gave way; but during the past week the other issue became concentrated upon the cases of Thorneycrofts, Middletons, and Humphrys and Tennant. These firms declined to be coerced; and inasmuch as the Secretary of the A.S.E. was declaring to all and sundry the determination of the Society to "press the matter right up to a " general adoption," there was by Saturday every appearance of the imminence of a deadlock.

The men's leaders gave notice to the resisting firms that, unless the concession asked for was made by that day, the men in the Societies represented by them would cease working. This notice expressed the hope that the obdurate employers would reconsider the position, and, by "gene- " rously adding the firm's name to the list of eight-hour " shops, prevent industrial war, so much to be deplored " by both employers and employed." The unctuousness of this phraseology was not calculated to make the demand more acceptable by the employers who had their own reasons for rejecting it. Nor did Mr. Barnes, the Secretary of the A.S.E., improve the prospects of his policy by advancing as one of the reasons for it the physiological necessity that mechanics should not work at their trade longer than eight hours a day. It is a pity that the agitators should attempt to veil their proceedings by these canting professions. Why not "out with it" in plain language, and tell the employers that their men want the eight-hour day without reduction of pay, and intend to get it if they can by the use of every means at their command? Meanwhile, the federated employers met again in Manchester last Thursday, when it was definitely decided that, in the event of the men's Committee calling out any of their members as threatened, the whole of the affiliated shops would thereupon discharge 25 per cent. of their Union hands. This would, of course, mean a strike and lock-out. But if the matter is to come to this, it will be as well for the action on both sides to be as general as possible. The men have at length succeeded in teaching their employers the advantages of concerted action. It may be expected that the "popular" newspapers will wax furious over the iniquity of meeting a London labour trouble by dismissals of men upon the Tyne, Wear, Tees, and all

over the North of England. But so long as a London strike could be supported by levies in these districts, it is surely elementary strategy to cut off the supplies by giving the Trade Union branches plenty of work to do for themselves.

Yesterday it was reported that the strike had begun by about 4000 men leaving their employment in London. The gravity of the situation thus created is generally recognized; but nobody seemed to know how far the trouble would extend, nor how it would end. The strike movement suffered some discouragement at the last moment by the defection of the Boiler Makers. The men's leaders have informed their sympathizers in the Press of their disbelief in the power of the masters to hold out against the pressure that will be brought upon them; but this statement must be taken for what it is worth. The whole question is one of business, and not of ethics; and no sentimental or physiological considerations will affect the issue.

Loss of the St. Anne's-on-the-Sea Bill.

The rejection by the Commons Committee of the St. Anne's-on-the-Sea Gas Bill is a pleasant incident of this year's parliamentary proceedings upon Private Bills which is calculated to inspire conflicting emotions in the breasts of diversely circumstanced observers of these matters. The Bill was accepted in March by a Committee of the House of Lords; whereupon the Gas Company, whose undertaking was proposed to be compulsorily acquired by the District Council under the conditions of the measure, determined to renew their opposition at the next stage. The result has justified the policy; but it is a staggering experience for those who are prone to think the Upper House a better guardian of vested interests than the Lower. The technical evidence in the case is not particularly edifying. The St. Anne's district is confessedly of a "mushroom" character; the settlement being an artificial creation of a Land and Improvement Company. But the same influences were at the back of the Gas Company; and the peculiar feature of the present parliamentary proceedings consists in the fact that it is the very people who were planted in the district by the operations of the Land Company who sought to dispossess the Gas Company of their property just as it is beginning to be profitable. It was, in short, sought to appropriate the "unearned increment" for the benefit of the rates, at the expense of those who had founded the undertaking, and nursed it through a callow and unprofitable youth. The Lords approved of this programme; the Commons did not. There is really nothing more to be said on the subject. Some of the past transactions of the Company have been unusual, not to say irregular; and for this they have been punished by the present expensive conflict. All the circumstances of the district are, however, exceptional. It is something to be grateful for that an onslaught on a Gas Company's property which could not be justified by reference to the conduct of the undertaking has been defeated by a Committee of the popular Chamber. The Company will now proceed to put themselves in order by applying to Parliament for incorporation in proper form; and this will give the District Council an opportunity of looking after the public interest without committing any wrong upon private property.

WATER AND SANITARY AFFAIRS.

It was a very striking feature in the recent debate in the House of Commons on the second reading of the Metropolitan Water Companies Bill that members who found fault with the measure, like Mr. Buxton (who denounced it as "a miserable little Bill"), nevertheless declared they would not vote against it. Even Mr. Stuart, who quarrelled with the Government for having tied their own hands by the appointment of a Royal Commission on the London Water Question, was found to say that he should certainly not oppose the Bill. From his point of view, it was a small and unimportant measure; but he clearly recognized that the Government could not undertake to bring forward a comprehensive scheme, seeing that to do this would be to supersede the Royal Commission, and render the coming inquiry useless. Hence he complained of the position in which the Government had placed themselves in regard to this subject. But it is evidently of no use to quarrel with the situation; and those who are dissatisfied may reserve their energies for the presentation of amendments in Committee. There is, indeed, some amount of dissatisfaction on both sides—the Companies requiring some modifications in the scheme, while Lord H. Cecil would bring into the Bill certain clauses which would very materially alter its character. The proposal that water-rates shall be decreased in proportion to every accidental diminution in the supply, is practically absurd, as well as unfair. How is the amount of diminution to be estimated; and if estimated in the aggregate, how is it to be applied locally? During the so-called water famine in the East-end, there were a large number of houses where no deficiency was experienced. Would the householders in such a case be entitled to share in a general discount? There is also the larger question of responsibility. Should a Water Company be held accountable in the event of a prolonged drought, by which all human efforts and calculations would be utterly baffled? From the Companies' side of the question, there is a very reasonable suggestion put forward by Mr. Boulnois—that, before a local authority are allowed to use the public funds in support of an individual complaint, the sanction of the Local Government Board or the Attorney-General should be obtained. We are glad to find attention called to a point which we specified when the Bill first appeared—namely, the extension of the provisions of the Metropolis Water Acts to the outer areas. This is a matter which affects the consumer as well as the Companies, and will certainly call, as intimated by Mr. Boulnois, for careful consideration. As usual, Sir John Lubbock offered some sensible remarks in the course of the debate; pointing out that the Bill did not profess to deal with the whole subject, but, so far as it went, it was a valuable measure. We have been inclined from the first to look upon the Bill as containing the germ of a final settlement, and as leading on towards that "solution" which is now somewhat impatiently demanded. Mr. Chaplin explains the existing state of affairs by saying that the present Bill is more or less a temporary measure, pending the report of the Commission. Our own belief is that what we may call the force of the Bill has been under-estimated.

The tactics of the London County Council as affecting the water supply of the Metropolis have been shown in their perilous character with respect to the Bill of the Southwark and Vauxhall Company. When the Bill had been approved by the Select Committee, and came before the House of Commons for consideration, Mr. Stuart moved as an amendment that it should be re-committed, so that certain evidence in opposition should be heard. As was well known, the purport of the Bill is to legalize an extra draught of water which the Company were taking from the Thames, against which excess an injunction had been obtained by the Conservators, subject to a suspension enabling the Company to make their present application to Parliament. The Bill was to be of a temporary character, so that there might be no interruption in the water supply of the district, pending the preparation of a further measure to be introduced in 1898, by which date the question would be permanently settled. The remarks made by Mr. Stuart in support of his amendment showed that the County Council had a very strong objection to anything in the nature of a permanent settlement, and wished the present Bill to be deprived of the clause by which provision was made for further legislation. The *status quo* was to be maintained until the Royal Commission had made their report. Of course, this affects the character of the present Bill, which is simply designed to regulate the *interregnum* preceding the settlement to be effected next year. If the question is to be hung up until the Royal Commission have reported, the scope of the Bill now before the House must be co-extensive. To maintain the *status quo* may be a reasonable demand on the part of the County Council; but, to meet this requirement, they may have to consent to a temporary measure of indefinite duration. Even when the Royal Commission have reported, the recommendations so given are of no effect until embodied in an Act of Parliament. In the meantime, if the injunction is enforced, a water famine will be the result; and of this even Sir F. Dixon-Hartland is afraid. An extraordinary statement was made to the House by Mr. Stuart—that the measure had been opposed on the ground that other Water Companies, if duly authorized by Parliament, were willing to supply the district in question with water. We fail to see what difference it can make to the Thames, so long as the 40 million gallons per day are

taken from the stream, whether the abstraction be effected by one Company alone or with the aid of others. Mr. Stuart omitted to say how long it would take to effect this peculiar and useless arrangement. Mr. Skewes-Cox, of Kingston-on-Thames, said he had no wish to prevent the Company taking from the river the water they required, but he protested against the great waste from leakage, and the consequent damage to roads. Mr. Skewes-Cox may take some consolation from the thought that if any of the water goes astray, it must necessarily find its way back again into the river bed. But time presses; and the Select Committee have recognized the question as governed by an emergency. Mr. Chaplin feels the force of the facts. The Thames Conservators are restless, the water is wanted for the needs of the people, and the President of the Local Government Board has a lively recollection of what came to pass in East London a little while ago. He told the House that he dare not take the responsibility of action which might contribute to a water famine in South London next summer, and if Mr. Stuart's amendment were pressed to a division he should vote against it. So Mr. Stuart withdrew his amendment, and the Bill was ordered to be read the third time. Yet had Mr. Shaw-Lefevre stood in Mr. Chaplin's place, South London might have shared the fate of East London.

Some further information as to the views influencing the London County Council in dealing with the Water Question is afforded by a report drawn up by the Parliamentary Committee of that body. As affecting the merits of the Bill promoted by the Southwark and Vauxhall Company, the Committee say they think the Council will agree with them that if Parliament permits the appropriation of further water from the Thames for distribution in London by "the commercial Companies," it should be taken and supplied by those Companies whose supply is most efficient, and whose rates of charges are lowest. On this ground, it is argued that the Southwark and Vauxhall Company should cease to supply Deptford, Bermondsey, and parts adjacent, and should allow the Kent Company to come in. Also that the West Middlesex Company should be permitted to supply Battersea, Putney, and Wandsworth. The Council go still farther, and deny that the Southwark and Vauxhall Company are under statutory obligations to supply water anywhere. "Other Com- "panies," it is said, "have long ago been authorized by "Parliament to supply throughout the whole area of this "Company in London." It would thus seem that the Southwark and Vauxhall Company might be improved off the face of the earth, and at present are only enjoying a permissive kind of existence. On so slender a basis nearly three millions of capital rest; and of so little validity are the various Acts of Parliament by which the Company have obtained their powers! We may ask: "Can such "things be?" We might almost go on to inquire whether the County Council possess all the authority to which they lay claim; and certainly we may doubt whether their knowledge goes so far as they think it does. It would seem that they are prepared to re-arrange the entire water map of London, if Parliament will only allow them to do so. But Parliament has a little too much respect for its own authority, and for the security of the interests which it has helped to create. The hostility of the County Council towards the Water Companies is further shown by a report from the Water Committee which is to come before the Council to-day. Purchase or no purchase, the Companies are to be sacrificed, if the Council can carry the day. But happily there is a power above the Council.

The London County Council and the Water Undertakings.—In the report above referred to, which is to come before the County Council to-day, five resolutions are recommended for adoption, the first three being as follows: "(1) That in the opinion of the Council the water supply of the Metropolis should not continue in the hands of private Companies. (2) That in the opinion of the Council the undertakings of the Metropolitan Water Companies should forthwith be purchased at the fair and reasonable value of the same, regard being had to the rights, special circumstances, and obligations of the Companies. (3) That the management of the supply should be effected either by the London County Council supplying its own area directly and outside authorities in bulk at a fixed price; or by the Council supplying its own area only, and the outside authorities supplying their areas; or by a new body supplying directly the whole area both within and without the county."

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-FOURTH ANNUAL GENERAL MEETING,

HELD AT

THE GUILDHALL, BATH, JUNE 15, 16, AND 17, 1897.

C. STAFFORD ELLERY, Esq., Assoc.M.Inst.C.E., President

PAPERS AND DISCUSSIONS.

NAPHTHALENE IN MODERN GAS MANUFACTURE, AND THE CARBURETTING OF ILLUMINATING GAS.

By WILLIAM YOUNG, of Peebles, and THOMAS GLOVER, of West Bromwich.

Of all the hydrocarbons produced during the carbonization of coal in the manufacture of illuminating gas, naphthalene has undoubtedly received the greatest attention from those engaged in the industry. This attention has by no means been voluntarily given through its value either as forming a part of the gas, or because of its value as a bye-product, but mainly on account of the trouble and annoyance it creates by being deposited as a crystalline solid in the manufacturing and distributing plant. Of late years, the troubles arising from the presence of naphthalene have become more accentuated—due to the fact that the modern system of carbonizing the coal at exceedingly high temperatures leads to an increased production of naphthalene; and the modern systems of condensing tends to leave diffused or suspended in the gas an increased quantity of the naphthalene present in the products of decomposition, and which has rather been aggravated than benefited by some of the modern systems of enrichment. The authors have been studying the subject in the light of these modern conditions, with the object of arriving at some means of overcoming the difficulties arising from naphthalene deposits; and they have devised certain methods which they believe experience will prove to be efficacious remedies, and which will also confer other concurrent advantages. The principles on which these are founded, they now propose bringing under the notice of the Institute.

The objects aimed at in the modern practice of gas manufacture may be summarized to consist in producing from the coal employed the largest possible volume of gas, possessing the largest sperm value in illuminating power, upon the least possible space. With modern appliances and modes of manipulation, the attainment of these objects involves that the temperature of the heat applied to the retort to carbonize the coal shall be extremely high, so that the constituents of the coal will be cracked up to such an extent that there will be just such a balance between the proportions of truly gaseous products and the volatile carburetting hydrocarbons, that the latter can be taken up and held in diffusion by the former in the truly gaseous state, at the same time that sufficient condensable liquid hydrocarbons are left to act as a solvent and prevent the choking up of the manufacturing plant with sooty pitch. They further involve that condensation shall be so conducted that the denser hydrocarbons necessarily left to prevent choking will not be allowed to exercise their solvent affinity for the carburetting hydrocarbons.

It has been found in practice that, while these conditions produce the highest value in pounds of sperm from a given weight of coal, it does not follow that the resulting gas is of the highest illuminating power that can be produced from such coal. Indeed, almost invariably the reverse is found to be the case—so much so that, with the commoner varieties of bituminous coals, the gas is of so low an illuminating power that it cannot be supplied by itself. It has further been found in practice, with the high temperature employed, that the common varieties of bituminous gas coals, owing to their constitution and molecular structure, are cracked up in such a manner as to leave, so to speak, comparative gaps in the series of hydrocarbons usually found present in the products resulting from the carbonizing of the same coals at lower temperatures. The paraffin hydrocarbons, with the exception of the lower member,

CH_4, are practically absent; while the easily decomposed creosoles and higher members of the olefine and benzol groups of hydrocarbons (having boiling-points and vapour tensions approximating to those of naphthalene, and which abundantly accompany naphthalene in the lower temperature products) are present in comparatively small quantities. These appear to be cracked up by the higher temperature heat, and their constituents re-arranged to form the highly stable hydrocarbon benzol and naphthalene, which stand out prominently among these products.

The changed constitution of the products from such coals, when carbonized at high temperatures, renders it exceedingly difficult to carry out the modern principles of fractional condensation by removing the condensed products from the presence of the gas as they are precipitated. For when the conditions during condensation become such as to lead to its precipitation, the naphthalene, being unaccompanied with a sufficient proportion of liquid hydrocarbons having approximately similar condensing points or vapour tensions, and which can take it up in solution, is necessarily precipitated in the more or less solid form, causing stoppages. The gas is also left saturated with naphthalene, and, in many cases, even with naphthalene held in mechanical suspension in an extremely fine state of division, which gives no end of trouble in its subsequent distribution, due to substantially similar causes to those producing the trouble in the manufacturing plant—namely, the excessive quantity of naphthalene present in the gas unaccompanied by hydrocarbon vapours having similar tensions to those of naphthalene; for, owing to naphthalene on assuming the solid form having no solvent affinity for vapours whose tensions are much greater than its own, the presence of the benzol vapours does not prevent it being deposited in the solid state.

The remedies—or rather the palliatives—which have been practically employed to overcome these difficulties have been of a twofold character; both, however, embodying the same chemical and physical principles. The first consists of adding so much cannel to the common bituminous coal. The cannel coal, owing to its different molecular structure, does not crack up in the same way as common gas coals when carbonized at similar temperatures, but yields products which, in a sense, fill up the gaps that are left in the products from the common gas coals. The cannels produce a much higher quality of gas and a larger quantity of liquid hydrocarbon products, which, while containing a comparatively small percentage of naphthalene, are yet rich in carburetting hydrocarbons, and contain paraffins to such an extent as to be objectionable from a tar distiller's point of view, and also a large percentage of the higher members of the benzol and other oxygenated hydrocarbons, having boiling-points and vapour tensions approximating those of naphthalene. The use of cannel, therefore, more or less, overcomes or palliates the difficulties of carbonizing at high temperatures, according to the quantity employed. It lowers the percentage of naphthalene in the gross products. It supplies an increased quantity of liquid products to take up the naphthalene in solution during condensation, and thus leaves the gas containing less naphthalene—such naphthalene being accompanied by vapours of liquid hydrocarbons having similar boiling-points and vapour tensions, thus lessening or preventing its deposition in solid form during distribution; and the carburetted hydrocarbon and rich gas from the cannel raise the illuminating power to the extent desired.

The second method of combating the difficulties arising from carbonizing at high temperatures, is to conduct the process of condensation so that the condensed liquid products are not removed from contact with the gas as they are precipitated, but are allowed to so far absorb the naphthalene from the gas before being drawn off as to more or less overcome the difficulties experienced in the manufacturing plant from the presence of the naphthalene. The conducting of the condensing process in this manner involves a partial absorption of the illuminants, as well as the naphthalene; and the gas is consequently of low illuminating power. To overcome this difficulty, the gas is enriched in various ways after manufacture, all of which are well known to the members, and to which it is unnecessary to refer in detail.

It is necessary, however, to point out that in these enrichment processes the enrichers added invariably possess—and designedly so—a very much higher vapour tension than the naphthalene, and consequently allow of the naphthalene condensing out of the gas before they themselves assume the liquid form; and therefore that they mainly modify or prevent the precipitation of naphthalene by their added gaseous volume tending to hold the naphthalene in diffusion. The popular idea that hydrocarbonaceous substances which are soluble in each other yield vapours which also dissolve each other, and thereby help to keep each other in gaseous diffusion, is altogether erroneous. The reverse is the case, for the very same conditions which enable the molecules of substance to dissolve in each other while in the liquid state, tend to keep them in the liquid condition, and prevent them assuming or remaining in the vaporous or gaseous state. Coal tar invariably contains volatile hydrocarbons which, when isolated, will volatilize into the gas from which they have been separated during condensation, due to the mutual solubility of the volatile hydrocarbons and the denser hydrocarbons present in the tar.

Practical experience has shown that, with modern appliances, the best results in sperm value are obtained by carbonizing coal at so high a temperature that there will be just such a balance between the truly gaseous and condensable hydrocarbonaceous products that the gaseous portion will be able to take up and hold in diffusion practically all the carburetting hydrocarbons present in the condensable portion; but it is yet questionable if, under all circumstances and conditions, such a system of carbonizing is the most economical. Recent experiences in the production of carburetted water gas prove that a much higher sperm value can be obtained from a given quantity of oil when the gas necessary to take up and hold the hydrocarbons is obtained from some outside source—that is, by the decomposition of water—than can be got from the same oil when cracked up by itself, as is the case with coal, so as to produce by the decomposition of a part of itself the whole of the gases necessary to take up the carburetting hydrocarbons in the residual liquid products.

The Peebles process of fractionally cracking up liquid hydrocarbons of various descriptions has further shown that a still greater gain in sperm value may be obtained from a given quantity of oil by employing a poor gas from some external source—such as water gas or poor coal gas—so as to take up and hold in diffusion the carburetting hydrocarbons as they are formed at the successive stages of the cracking up of the oil. By thus employing the extraneous permanent gas, the carburetting hydrocarbons are carried away as formed and prevented from being returned to the retort to undergo further decomposition, which would be destructive. It may be instructive to state in this connection that, when a gallon of benzol is employed as a carburetting medium diffused through water or poor coal gas, it will give an illuminating value of from 2000 to 5000 sperm candles, dependent upon the structure of the gas carburetted and the percentage used; and that when the same quantity of benzol is cracked up so as to produce sufficient gas to take up the residue in diffusion, the utmost attainable sperm value is not equal to one-fourth part of that secured when employed as a carburetting medium. While, therefore, it may be quite true that a coal may, when carbonized at a medium temperature, yield 8000 cubic feet of (say) 18-candle gas, equal to 28,800 sperm candles, and the same coal carbonized at a high temperature may yield 10,000 cubic feet of 16-candle gas, equal to 32,000 sperm candles, yet the tars from coal distilled at low temperatures might contain such a quantity of carburetting hydrocarbons that, if poor gas from some external source were brought in contact with it, it would confer an enrichment far greater than that necessary to bring up both volume and illuminating power in excess of the gas obtained from distilling the coal at the high temperature. The carbonizing of the cannel coal along with the common coal, or even in combination with the coal in such a way that their products commingle in the hydraulic main, is undoubtedly a ready and convenient way of overcoming the difficulties arising from high temperatures. There is, however, no doubt but that it is wrong in principle.

When the object is to remove the ammonia from the gas, the water produced during the carbonizing of the coal is first allowed to act upon, and become as far as possible saturated with, ammonia salts; and the required quantity of pure water is subsequently employed to remove, in any of the well-known forms of apparatus, the last traces of ammonia. The gas manager would never think of adding

the water for the absorption of the ammonia to the products in the hydraulic main, simply because the affinity of the water for the ammonia would be largely modified on commingling with the ammoniacal liquor; and no amount of subsequent contact between the diluted ammoniacal liquor would ever free the gas from ammonia. Now, in a similar manner when the cannel coal products are commingled with the products from the common coal in the hydraulic main, the power of the cannel coal products to absorb the naphthalene, is largely modified by commingling with the very large volume of naphthalene vapours present at this point in the common coal products. On the other hand, the proportionately large quantity of very dense hydrocarbons present in the common coal products absorb from these products part of the carburetting hydrocarbons present therein. Thus a very much larger proportion of cannel coal products is required to perform the double function of absorbing the excess of naphthalene and doing the duty of carburetting and bringing up the coal gas to the desired illuminating power, than would be necessary if applied as water is to the gas to absorb the ammonia.

As has been already explained, the modern system of enriching coal gas by volatile hydrocarbons fails to prevent naphthalene deposits, owing to their vapour tension being so much higher than that of naphthalene, that the naphthalene begins to condense out of the gas in the crystalline solid form long before the tension of the carburetting vapours is so far reduced as to cause them to assume the liquid condition, and thus enable them to act as a solvent.

The naphthalene may thus be largely deposited as a solid in one part of the distributing plant, and the carburetting vapours subsequently deposited as a liquid in a more distant part, on the gas being subjected to still lower temperatures.

These remarks shadow forth the authors' views of the conditions obtaining in existing processes of manufacture bearing upon the naphthalene problem, and indicate the broad principles by which they have been guided in devising means to solve the difficulties arising from the presence of naphthalene. A study of these principles naturally suggested three modes of solving the problem:—

1.—Modifying the carbonizing and condensing process in such a manner as to avoid the defect referred to.

2.—Scrubbing or washing the naphthalene-charged gas after condensation, by means of a supplementary quantity of hydrocarbon fluid for the removal of the naphthalene in a manner similar to that by which ammonia is removed from the gas.

3.—Carburetting the naphthalene-charged gas with the vapours of a hydrocarbon fluid, having vapour tensions approximating that of the naphthalene so that, when the naphthalene was precipitated from the gas, it would be accompanied by a sufficient quantity of liquid hydrocarbon to keep the naphthalene from being deposited in the solid form.

The modifications in the carbonizing and condensing process could be varied dependent upon local conditions; but the guiding principles in all cases would be to carbonize or gasify the coal in two portions. One portion would be carbonized at the high temperature, mainly to produce a volume of gas to take up the carburetting hydrocarbons from a second portion carbonized at a lower temperature to produce products practically free from naphthalene, and rich in carburetting hydrocarbons, so as to remove the naphthalene from the high temperature gas and raise its illuminating power.

Under conditions where bituminous coal was low in price, and in which the resulting coke could be easily disposed of, such coal would be carbonized in the ordinary manner at high temperature to produce a volume of gas. A second quantity of coal of the same or superior quality, or it may be cannel, would be carbonized at a lower temperature, producing gas of high quality and liquid condensable products practically free from naphthalene. The high temperature gas would be condensed in the usual manner, so as to remove the greater part of the condensable impurities—tar and naphthalene—and thereafter brought into contact in any convenient manner with the products resulting from the carbonizing of the coal at the comparatively low temperature. The result would be that the comparatively small quantity of naphthalene present after condensation in the high temperature gas would be absorbed; and at the same time the high temperature gas would be carburetted and enriched by the products resulting from the coal carbonized at the lower temperature.

The relative proportions of the coals carbonized at the different temperatures would be varied, dependent upon the character of the coals and the quality of the gas required. By thus conducting the process, a much smaller quantity of cannel or other coal would be required for enriching and washing the gas than by the ordinary method of carburetting. When, on the other hand, the coals were costly or the coke difficult of disposal, the coals might be carbonized either in the ordinary retorting or other modified arrangement, but at temperatures that would produce as rich a gas as possible and a large yield of liquid hydrocarbon products, containing little or no naphthalene. A part of the coke resulting from the carbonizing of the coal at the lower temperature, together with the liquid products, would be subsequently employed to produce water gas in a separate apparatus; the carburetted water gas being thereafter brought into contact and washed with the products resulting from the carbonizing of the coal at the lower temperatures. By thus manipulating the process of gasifying the coal, a considerable part of the permanent gas required to take up and retain the volatile hydrocarbons in diffusion would be produced by using the residual coke to decompose water; and the hydrocarbonaceous portion of the coal would be conserved and devoted to a larger extent to the purpose of conferring illuminating power upon the gas.

It will further be observed that, by the adoption of either of these two methods of carbonizing the coal, a better balance may be obtained between the necessary plant and the supply of coal and labour than by the ordinary process. During the period of the minimum demand, in works supplying high-grade gas, the retorts could be kept in use to a large extent carbonizing at the lower temperature, producing the necessarily small volume of gas of the desired quality, and a large volume of liquid products; these liquid products being stored and worked up during the time of maximum demand in carburetting water gas, involving the minimum of labour and space for the maximum supply. These methods of carbonizing would also offer facilities for carbonizing coal in bulk in large coking chambers, inasmuch as the products, however first evolved, could ultimately be converted into illuminating gas. Both these modified processes would further possess the advantage that the supply of coke and tar could be regulated to the consumption demand, and thus prices could to some extent be regulated.

Conditions might obtain in connection with a works where the hydrocarbon necessary to treat the gas produced from coal carbonized at high temperatures, so as to overcome the difficulty arising from the presence of the naphthalene and to raise the illuminating power of the gas, could be more economically obtained from an outside source than by carbonizing a part of the coal at low temperatures. Under such conditions, the hydrocarbon fluid could be employed in a similar manner to that described when the low temperature products from the coal are used. The high temperature gases would, in this case, be washed in a limited quantity of liquid hydrocarbon in a suitable scrubber, in the same way that water is used to wash the gas and free it from ammonia. The hydrocarbon liquids which are best suited to this purpose would be those having a high solvent affinity for naphthalene vapour—such as the distillates from coal or oil gas tars, or the oils recovered from blast-furnace gases.

In the event of the hydrocarbon liquid being of such a constitution as to render it unsuitable, owing to high density or absence of volatile hydrocarbons, to wash the naphthalene from the gas, it could be first subjected to carbonizing or cracking up at low temperatures; and thus have its constitution altered, and so adapted to treat the high temperature gases, so as to do the joint duty of carburetting and removing the diffused naphthalene from the gas. Or the washing oils may be purified free from naphthalene held in solution, by being cooled to a low temperature, which would cause the naphthalene to separate as crystals; the oil being thereby rendered fit for use again as a washing agent. If these oils are used for washing purified gas, it might be found necessary to effect their further purification by the use of a limited quantity of caustic soda and sulphuric acid, to

remove some of the dissolved sulphur and basic compounds. In washing the gas with oils in the manner just described, it would be necessary to exercise due care to see that the temperature of the washing fluid was kept as uniform as possible, and slightly above that of the gas being treated. Fluctuations in temperature, by altering the solvent power of the liquid hydrocarbon and the vapour tensions of the volatile hydrocarbon held in solution, would lead to fluctuations in the illuminating power, owing to the greater or less quantities of volatile hydrocarbon absorbed from or given up to the gas.

The action of the liquid hydrocarbon, when first brought into contact with the gas, would vary dependent upon its constitution. Should it contain a considerable quantity of volatile hydrocarbon, it would, while taking up the naphthalene vapours, also at the same time part with some of the volatile hydrocarbons to the gas. Should, on the other hand, the liquid hydrocarbon contain a small quantity or no volatile hydrocarbon, then not only would the naphthalene vapour be absorbed from the gas, but also the other diffused volatile hydrocarbons; and this action would continue till a balance obtained between the solvent power of the liquid hydrocarbon and the tension of the hydrocarbon vapour in the presence of the gas. Such a balance of affinities would soon be attained. But in practice it would be better to add to the liquid hydrocarbon deficient in such volatile hydrocarbons the necessary quantity, before passing it into the washing arrangement; and a convenient method of carburetting would be to add from time to time the necessary carburetting fluid to the scrubbing liquid hydrocarbon. Such addition would not interfere with the dissolving out of the naphthalene, as from the lower vapour tension and the practical freedom of the solvent fluid from naphthalene, that substance would continue to be absorbed while the high vapour tension of the other hydrocarbons leads to its volatilizing into the gas.

On the solvent hydrocarbon liquid becoming so charged with naphthalene that it could no longer dissolve the naphthalene from the gas, it would be drawn off from the scrubbing arrangement and cooled to a low temperature, and the crystallized naphthalene removed by passing through a filter press. Or alternatively, where convenient, the liquid hydrocarbon might be distilled, and the fraction containing the major part of the naphthalene separated, cooled to a low temperature, and filtered; the whole distillate being thereafter again mixed. The liquid hydrocarbon, thus freed from naphthalene, would be again returned to the scrubbing arrangement for further use. By thus using the same hydrocarbon fluid over and over again, nothing but the denser vapours of naphthalene and other hydrocarbons could be removed from the gas or lost. The temperature of the absorbent hydrocarbon would be so regulated that the volatile carburetting vapour would either not be absorbed, or, if absorbed, again revolatilized into the gas. Not only so, but by adding volatile liquid hydrocarbons, they would be made to do the double function of washing the naphthalene vapours out of the gas, and thereafter being themselves volatilized into the gas; thus conferring upon it additional illuminating power.

This process could be very conveniently introduced into works possessing tar-distilling plant. The early part of the distillate could be isolated and freed from naphthalene by refrigeration, filtered, and thereafter employed to scrub the gas to absorb from it the naphthalene, and to carburet the gas. On becoming charged with naphthalene, it could either be run from the scrubbing arrangement to the tar well, or returned direct to the still to be distilled, cooled, and again prepared for re-use in scrubbing the gas.

Where the conditions connected with a works are such that neither of the methods which have just been described for dealing with the difficulties arising from the naphthalene deposits can be adopted, a modified carburetting process will be found to greatly reduce, if not completely remove, these difficulties; for, as already explained, crystalline solid naphthalene deposits only take place from gas when the naphthalene vapours are present in the gas unaccompanied by the vapours of liquid hydrocarbons having similar vapour tensions. It is therefore evident that, by carburetting naphthalene charged gas with the vapours of liquid hydrocarbons having similar vapour tensions, whenever the conditions become such as to cause the precipitation of the naphthalene from the gas, the vapour of the liquid hydrocarbon will be simultaneously condensed, and will take up the naphthalene in solution.

It is further evident that, in employing such a process, the quantity of the vapours of the liquid hydrocarbons added to the gas must be carefully adjusted to that necessary to prevent the troubles arising from naphthalene deposits; for whenever the conditions during the distribution of the gas become such as to cause the precipitation of the combined naphthalene and liquid hydrocarbon vapours, they invariably, owing to their liquid condition and their solvent affinity, take down with them from the gas a portion of the other carburetting vapours, which reduces the luminosity of the gas—these condensable matters, of course, requiring to be pumped from the drip-traps and returned to the works.

ON THREE YEARS' USE OF CARBURINE AS AN ENRICHER.

By Joseph Davis, of Gravesend.

In redeeming a promise made some time ago to the President to prepare a short paper to be read at this meeting, the author thought that an account of the experience he has gained on the enrichment of coal gas with carburine spirit and the Maxim-Clark carburettor would probably be of interest, and would also give rise to some profitable discussion.

Previous to the introduction of the Maxim-Clark apparatus at the Gravesend Gas-Works, enrichment was entirely with cannel, and this, as far as possible, the best of its kind; for being so far away from the cannel coal-fields, it always appeared to be more economical to use a small quantity of the richest procurable, rather than a large amount of the so-called cheap cannels. The freight in each case would be about the same; while with the latter, the coke runs the risk of being very much deteriorated. The cannel used—known as "North Wales Curley"—was probably, with the exception of Australian Boghead, the richest cannel in the market; being considerably superior to Lesmahagow. The price was 47s. 6d. per ton free alongside the Gravesend Gas-Works wharf, or 49s. 4d. delivered on the works. It was this high price, and the strong probability that it would rise even higher, which caused the author to look for some other process of enrichment; and, after some inquiry, the Maxim-Clark system was found best fitted to the requirements, and was ultimately adopted by the Directors of the Company.

There were several reasons which led the author to recommend this system. Probably the strongest of these was the fact that he had long seen and felt the necessity for some ready means for enriching the gas into the town quickly and permanently, when from some carelessness or unavoidable accident in the retort-house or works generally, air or furnace gases had been drawn in with the gas, and so reduced to a more or less extent its illuminating power. He has seen cannel thrust into the retorts in abnormal quantities, regardless of cost, to remedy these mishaps—mishaps which every gas manager or engineer has more or less experienced. But the process of the cure has been so slow, that before it has been accomplished, the consumer—and it may be the official tester also—has been made unpleasantly aware of the occurrence of the accident. These difficulties have now been completely overcome; for should at any time the gas issuing to the town be found below the prescribed standard, in a very few minutes, by means of the Maxim-Clark apparatus, the illuminating power can be brought up to its proper standard.

The apparatus (fig. 1, p. 20) may be described as follows: The evaporator A is in the form of a vertical tubular boiler; the tubes running between two plates, which latter are fixed at about 8 inches distance from the top and bottom casing. Steam is introduced between these plates and the outside of the tubes by the pipe G. The enriching material is pumped through the pipe D from the store tank by a small steam-pump C, through the pipe E, into the evaporator, at a point below the bottom plate, and is forced up inside the tubes; the effect being that the spirit is evaporated, thus forming a pressure of vapour, which is conducted by a tube F fixed above the top plate of the evaporator to a regulating valve J placed on an injector B, which is connected to the gas-main K, containing the gas to be enriched, by small pipes L, M, at two points a short distance apart. The vapour under pressure is allowed to pass through the regulating valve into the injector, forming

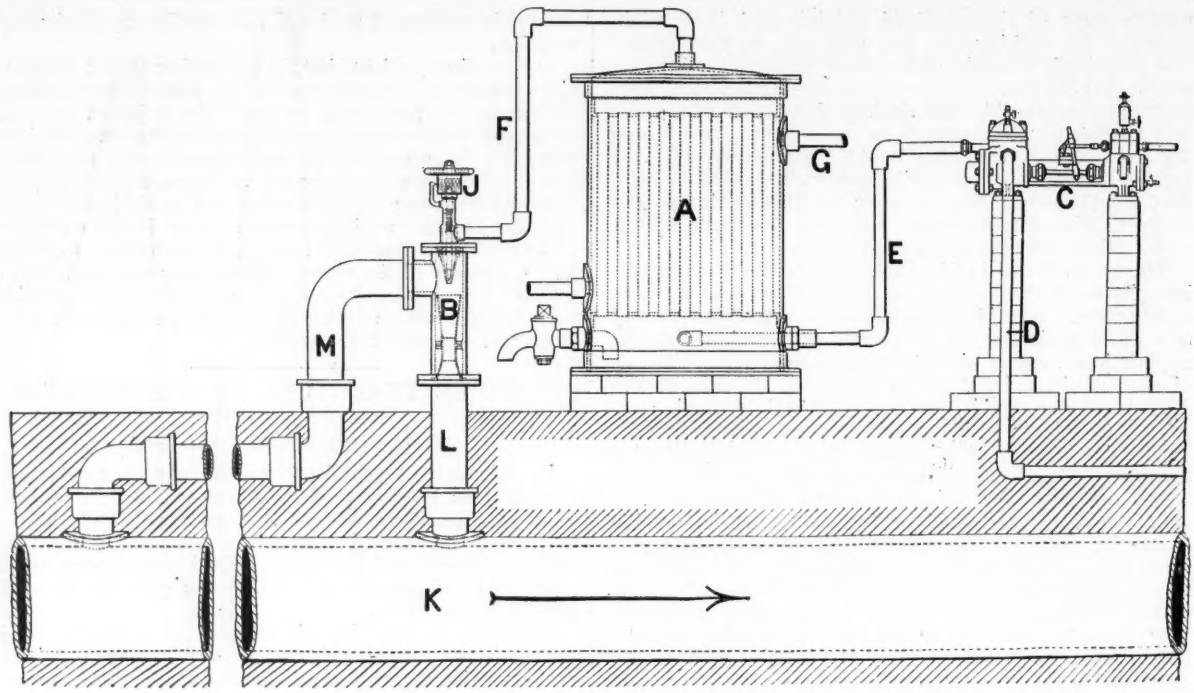


FIG. 1.—THE MAXIM-CLARK APPARATUS AT THE GRAVESEND GAS-WORKS.

a partial vacuum at the top of it, to which one of the small gas-pipes is connected. The effect is that the coal gas is drawn into the injector, where it mixes with the hot vapour and forms a very rich gas, which is then driven through the second connection back into the gas at a point nearer to the gasholder or the consumer. The quantity of vapour is easily regulated by the valve on the injector.

At the Gravesend Gas-Works the carburettor is fixed in the meter-house, and is connected up to the inlet and outlet mains of the gasholders with pipes 6 inches in diameter. Into the evaporator, a small steam-pump lifts the spirit from a steel tank of 1000 gallons capacity, fixed and sunk in the ground outside. To the evaporator is attached a gauge-glass, reaching from the top to the bottom, and properly protected, so that the amount of spirit pumped in can be readily seen and the evaporation gauged. A steam pressure-gauge is fixed on the top of the evaporator, which records the pressure of the vapour before passing to the injector. The spirit employed is of ·680 sp. gr.

There are several methods of using the apparatus. The evaporator may be first filled with spirit to within about 8 inches of the top of the gauge-glass, and the pump then stopped and steam gently turned on until the pressure of the vapour amounts to 30 lbs. on the square inch, as shown by the gauge. The injector, which will have previously been slightly opened, may now be regulated as desired, according to the candle power required. If the gas has to be raised 1 to 1½ candles only, some time will elapse before the apparatus requires refilling. But this, of course, will depend upon the quantity also of the gas to be enriched. By this method, however, there is at first just a risk of the evaporator priming, which means a probable loss of spirit; and it is therefore not to be recommended.

Another way is to half fill the evaporator and proceed as before; but this naturally requires more attention, and, if neglected, the gas will be found what is termed "patchy." Perhaps the better method, and the one the author finds most economical, is to pump into the apparatus sufficient spirit to rise about 1 or 2 inches in the tubes, and, after regulating the injector, to turn on the steam to the required degree, and keep the pump very slowly going to compensate the amount being evaporated. With a little experience, any difficulty that may arise will soon be overcome. It should, however, be understood that, the higher the pressure of the vapour in the evaporator, the more perfect will be the enrichment, and the more economical will the carburettor be found. It will be seen that the greater the vacuum on the coal-gas inlet to the carburettor, the quicker the flow back to the primary main—resulting in a better and more permanent mixture.

In the author's arrangement, he is enabled to enrich direct into the holders through the station meter or direct into the town at the inlet of the governors, as may be desired. In enriching direct into the town, the best results are gained at night, when there is a rapid flow of gas through the mains. There is then no difficulty in keeping the illuminating power at a fixed value. In the daytime, however, and particularly in the summer when the consumption is small, there may be found some trouble in keeping the illuminating power properly within bounds; and unless due attention be given, the economy of the apparatus will be severely tried, and some disappointment probably accrue. Indeed, for some time from the commencement of the use of the apparatus at Gravesend until the storage capacity was increased, at night enrichment was practically taking place both on the inlet of the holders and direct into the town. It was customary to supply the town at night from one particular holder, feeding this as required from others, as well as working direct into it; and as the storage capacity was very small, the gas would simply be passing up one pipe and down the other. From midnight, and during the day, the holders would, of course, be refilled; one holder containing gas of the necessary quality supplying the town in the meantime, sufficient for the day's requirements having been previously put into it. When this was done, the carburettor would be shut off until the evening. Some eighteen months ago, having completed a new holder which considerably more than doubled the previous storage capacity, it was possible to adopt another system which has given considerable satisfaction.

During the summer months, the carburettor was found too large to deal economically with the small consumption then going on—that is to say, as economically as during the winter months—and it occurred to the author that one holder might be constantly filled with a rich gas, and worked out with the gas to be enriched. It was necessary, of course, that it should be the heaviest holder as regards pressure; and as there was no difficulty in this direction, the plan was tried. The carburettor would be put to work at about seven o'clock in the morning; and the gas being stored was raised from an average of 14½ candles to from 20 to 22 candles, and delivered into this heaviest holder. This would go on until about sufficient gas was stored for the night's requirements (which quantity was soon determined by experience); and the carburettor was then shut off for the day. To keep up the illuminating power of the gas during the day, a 2-inch bye-pass, with a steam wheel valve attached, was placed on the outlet-valve of

the holder, and regulated to the desired degree; while at night the outlet-valve itself was slightly opened, more or less as required. By this method, there is no difficulty in keeping the gas supplied at one fixed standard, without those vexatious variations which at times will, and do, occur on the best-regulated works.

The author has been asked on several occasions if the gas so enriched remained permanent, or if there had been found any deposition of the spirit in the syphons or in the gasholder itself. Though he has very carefully searched for it, no deposition, or any trace thereof, has ever been discovered in the syphons, either on or off the works—not even during the coldest weather. During the first week of January, 1894, the cold was so intense that the greatest difficulty was experienced in maintaining the illuminating power at anything near the prescribed standard of 16 candles at the outlet of the gasholders. At this time the enrichment was effected by means of spirit direct into the holders, the connection between the apparatus and the inlet of the governors not being completed; and a very large amount of spirit—about double the usual quantity—was required. Being suspicious that the carburine gas was, in consequence of the low temperature (19° to 21° Fahr.), becoming condensed in the gasholders, it was determined to go back to cannel again; but though 8 per cent. of Welsh Curley cannel was used—or double the usual amount—no better results could be obtained. A return was therefore made to carburine. No plainer proof was required of the fact that during extremely low temperatures, the rich hydrocarbons in the illuminating gas are considerably affected, whether the gas be produced from cannel, carburine spirit, or the ordinary coal itself.

In the case just mentioned, while 18-candle gas, as determined by the jet photometer, was being put into the gasholder, the power of the issuing gas from the same holder, at the inlet of the governors, barely reached 16 candles. The fact of this being the same when using either cannel or spirit, justifies the belief that coal gas enriched with carburine vapour is quite as permanent as that enriched with cannel. At the Gravesend works, three jet photometers are placed in the engine-room for the guidance of the foremen and enginemen; and these are connected severally to the outlet of the exhauster, the inlet of the station meter, and the inlet of the governors—a small purifier being placed on the inlet of the first photometer. These photometers are also connected up singly with the bar photometer in the laboratory, and regulated with the latter instrument every morning.

Up to the time of adopting the system of putting a rich gas into a separate holder, the author failed to perceive any trace of deposition in the gasholders themselves; but since then he has found in this particular holder traces of some deposition having taken place. This, however, is scarcely to be wondered at. In using a coal which will give upon an average about 10,200 cubic feet of 14½-candle gas per ton, there must be times during the period of carbonization when the gas coming away from the retorts is only of 12-candle power, and sometimes even lower than this. In the case of an accident in the retort-house, when a bed of retorts has "slipped its seal" and air or furnace gases have been drawn in, the author has known the illuminating power reduced to 8 candles. Now should the carburettor be at work when this takes place, and attempts be made to raise this 8-candle gas to 22 candles, it is reasonable to suppose some deposition must take place; the gas being probably over-saturated. No doubt this is what occurred in the instance referred to.

It is very interesting to know what actually takes place during the process of carbonization, hour by hour; and if every manager were to carry a small pipe from the outlet of his exhauster to his bar photometer, putting in a small purifier *en route*, and take a series of tests of the gas which was being made, the results would probably surprise him. The diagram appended (fig. 2) is one of a series recorded at Gravesend, and is probably a fair representation of what is taking place to a more or less extent in every retort-house. On the whole, however, the author's experience proves that there is no difficulty in raising gas of an illuminating power of 12 candles to 22 candles, without fear of deposition.

There is another important question concerning the enriching of coal gas with this ·680 spirit. Is the gas so enriched permanent over the whole of the district? The writer has every reason to believe it is. Though the

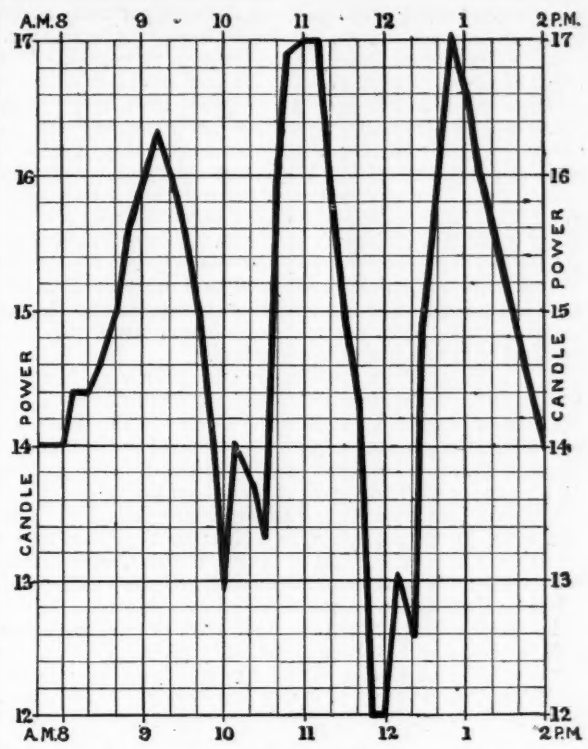


FIG. 2.—ILLUMINATING POWER TESTS AT OUTLET OF EXHAUSTER, MARCH 16, 1897.

Average Illuminating Power, 14·99 *Candles.*
Gas Made, 89,000 *Cubic Feet.* *Coal Carbonized*, 8·75 *Tons.*
Gas per Ton, 10,170 *Cubic Feet.*

Gravesend output amounts to nearly 120 millions per annum, the area of supply is comparatively small. But from tests made at various points a mile away from the works—carried out with the aid of a Sugg illuminating power meter, which had first been checked and rated with the bar photometer—little or no difference was found between the gas leaving the works and that tested away. The conclusion, therefore, is that the gas enriched by this process is quite permanent. It may be added that the testings at the works and at the various points a mile away were carried out simultaneously.

The assertion that this method of enriching gas prevented to a large extent the deposition of naphthalene in the mains and service-pipes—carburine being a solvent of naphthalene—the author can confirm. Though at Gravesend he has never at any time had serious trouble with this bugbear, either on or off the works, still there are occasions, in the spring or fall of the year, when a comparatively large number of complaints of "bad supplies" are received, the majority of which result from the deposition of naphthalene in the service pipes or meter connections. It is found that by sending into the town for a time gas enriched with carburine up to about 20-candle power, these complaints have been greatly reduced, and, so far as naphthalene is concerned, have vanished altogether.

Undoubtedly there is considerable saving in adopting this process. The following table gives the cost per 1000 cubic feet for enrichment from June 24, 1892:—

GAS RAISED FROM 14½ TO 16 CANDLE POWER.

Year ended June 24.	Gas Made, Thousands.	Cannel Used.	Spirit Used.	Total Cost of Enrichment.	Cost per 1000 Cub. Ft. Gas made.	Make of Gas per Ton of Coal and Cannel only.
	Cub. Ft.	Tons.	Galls.	£	d.	Cub. Ft.
1893	108,569	440	—	1016	2·24	10,300
1894	108,383	55	21,249	938	2·07	10,550
1895	111,784	179	24,666	1157	2·48	10,460
1896	111,245	230	15,525	1024	2·20	10,280
*1897	99,461	71	21,453	902	2·17	10,390

* To April 1, 1897.

During the year ended June 24, 1893, when cannel only was used, the cost per 1000 cubic feet for enrichment was 2·24d. For the year ending June, 1894, when for about

nine months spirit only was used, the cost per 1000 cubic feet was reduced to 2·07d; and it is highly probable that, but for the extraordinarily severe weather experienced in the early part of that year, this figure would have been still lower. For the year ended June, 1895, there is a considerable increase. This may be accounted for in several ways. During that year a quantity of cannel which had been salvaged from a damaged ship was purchased. It was very cheap, but only equal to a good Yorkshire coal; and even then at times while using it, the aid of carburine had to be called in. The coals too were not up to the usual standard; the consequence being that in this year the cost of enrichment went up to 2·48d. per 1000 cubic feet. For the year 1896, when one-half cannel and one-half spirit (or thereabouts) was used, the cost dropped to 2·20d. per 1000 cubic feet.

The average of all these figures is still a very low one for enrichment; but it must be remembered that the cannel used up to June, 1896, with the exception of the cheap lot just referred to, was a very rich one, considerably superior to the best Lesmahagow. Mr. J. W. Field, the Secretary and Manager of The Gaslight and Coke Company, in his "Analysis" gives one ton of Lesmahagow cannel as being equal to 50 gallons of ·680 spirit; but the author's experience is that one ton of North Wales Curley cannel was equal to 63 gallons of ·680 spirit. Upon writing Mr. Field on the matter, he corroborated this figure.

From June 24, 1896, to April 1 of the present year (1897) carburine has been principally used. Previous to June, the Welsh Curley cannel pits had been worked out and closed, so no more of it was procurable. However, to provide for any failure in the supply of spirit, or any other emergency, a small stock of cannel is stored, of a kind which, from the published analysis, was shown to be superior to Lesmahagow; and 71 tons of it have been used during this period. Experience of this cannel, however, does not agree with the analysis published, even after allowing the usual discount for practical working. But taking 1 ton of it as being equal to 50 gallons of carburine—which is a doubtful value—and comparing it with the cost of the spirit, it will be seen from the foregoing table that during the period from June 24, 1896, to April 1, 1897, 21,453 gallons of spirit were used; and if this be reduced to tons of cannel, taking 50 gallons to equal one ton, it would bring the amount to (say) 429 tons. This cannel would cost, delivered into the retort-house at Gravesend, not less than 44s. per ton; and it has cost more. The price of the spirit is 8½d. per gallon, delivered on rail at Gravesend—a price which probably can still be reduced. Therefore—

429 tons of cannel, at 44s. per ton delivered . .		£943	16 0
21,453 gallons of spirit at 8½d. per gal.	£759 15 10		
Delivery of spirit on works . . .	10 5 7		
		770	1 5
Difference		£173	14 7

or a saving in the raw material alone of £173 14s. 7d. It is difficult to arrive at the actual gross saving; but it must be seen that, after making due allowance for residuals, there still remains a further considerable saving when carbonization and purification are taken into account—the carburettor requiring steam only, and very little of that.

The author has been making some experiments with an apparatus which he devised, with a view of ascertaining the illuminating power of the gas as it issues from the

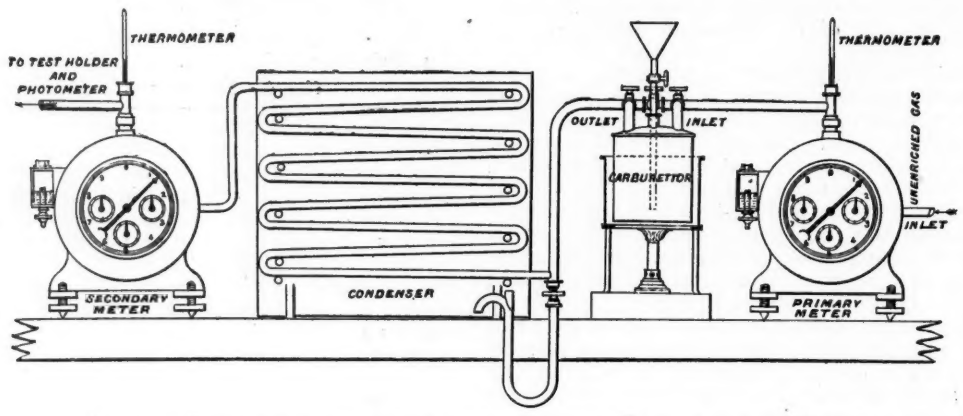


FIG. 3.—EXPERIMENTAL TESTING PLANT AT THE GRAVESEND GAS-WORKS.

carburettor. The apparatus (fig. 3) was arranged as follows: Two experimental wet meters, of equal size and capacity, made expressly for the purpose, were placed on a bench about 5 feet apart. These may be called the primary and secondary meters. Between them was placed a cylindrical copper vessel, having an inlet and outlet pipe with cocks fitted on; while in the centre of it a glass funnel with stopcock was also fixed. This was to act as a carburettor; and it was immersed in another vessel containing water. A condenser, consisting of 100 inches of ½-inch compo. pipe, was fitted between the carburettor and the secondary meter, having a syphon attached to it; the whole being then connected up together with a 10 cubic feet test holder. From the latter, a pipe was taken to the bar photometer. Thermometers were placed on the outlets of the two meters; and a record of the temperatures was taken. The inlet of the primary meter was connected up to the works' main, from which the gas was taken. It was desired, not only to arrive at the actual value of the carburine gas produced, but also to determine, if possible, the actual increase in bulk of the enriched gas. The meters were first levelled up and accurately rated together, and also compared with the test holder. Five feet of gas was passed through the meters into the holder; and when they were each found upon comparison to register exactly this quantity, the holder was emptied, and the experiments proceeded with.

First, half a pint of spirit was placed in the carburettor, and heat applied to the water vessel; the inlet-cock being shut off, the outlet open to the condenser, &c. The result was merely a distilling operation; for as fast as the spirit evaporated in the carburettor, it condensed and fell back into the condenser syphon—the secondary meter remaining quite stationary. Directly the gas was turned on through the primary meter, this condensation to some extent ceased. Further experiments were tried by gradually reducing the quantity of spirit put into the carburettor; and it was found that 1 fluid ounce was about the right quantity to use with the apparatus to make certain there would be no condensation. Experiments were then made to determine the extent to which 1 fluid ounce, or $\frac{1}{160}$th part of a gallon, would enrich 10 cubic feet of coal gas. To do this, 1 fluid ounce was put into the carburettor and evaporated off very slowly—the temperature of the water being not higher than 110° Fahr.—and at the same time 10 feet of gas was passed through it, as registered by the primary meter. The enriched gas was passed through the condenser to the secondary meter; and from thence it was taken to the test holder.

The following table gives the results of six tests; the gas being tested on the bar photometer, before and after enrichment, with the Methven screen. No allowance has in either case been made for temperature or barometrical pressure at the testing-places.

Test.	Quantity of Spirit Used in Parts of a Gallon.	Gas Registered by First Meter.	Temperature.	Gas Registered by Second Meter.	Temperature.	Increase of Gas in Bulk.	Illuminating Power of Primary Gas.	Illuminating Power of Enriched Gas.	Increase in Illuminating Power.
No.	Gal.	Cub. Ft.	Fahr.	Cub. Ft.	Fahr.	Cub. Ft.	Candles.	Candles.	Cdls.
1	$\frac{1}{180}$	10·0	47°	10·150	47°	0·150	14·50	19·50	5·00
2	$\frac{1}{180}$	10·0	52°	10·145	52°	0·145	13·75	19·00	5·25
3	$\frac{1}{180}$	10·0	50°	10·150	50°	0·150	16·20	21·00	4·80
4	$\frac{1}{180}$	10·0	52°	10·155	52°	0·155	14·50	19·25	4·75
5	$\frac{1}{180}$	10·0	54°	10·145	54°	0·145	15·00	20·00	5·00
6	$\frac{1}{180}$	10·0	61°	10·160	61°	0·160	15·30	20·40	5·10
Av.	$\frac{1}{180}$	10·0	52°	10·150	52°	0·150	14·88	19·86	4·98

From the results of the above experiments, it appears that, with $\frac{1}{180}$th part of a gallon of ·680 spirit, 10 cubic feet of gas can on the average be increased to 10·150 cubic feet, and the illuminating power be raised by 4·98 candles. This would represent, therefore, that 1 gallon of carburine produces 24 cubic feet of 352-candle gas; thus—

Cubic Feet.		Candles.		Sperm Value.
10·00	of	14·88	=	3571 grains
0·15	of	352·00	=	1267 ,,
10·15	of	19·86	=	4838 grains

Further experiments with the apparatus and carburine spirit are in progress; but they are not sufficiently advanced to be dealt with in this paper. It seems impossible, however, to arrive at any determination as to the illuminating power of the spirit vapour *per se*, for the reasons mentioned. It must be brought into contact with the coal gas and in sufficient quantities of the latter to completely absorb it; otherwise condensation, and consequently loss, will occur.

The author had had some practical experience of this previously. Some time ago, hearing of what had been done by enriching with spirit vapour, either at the outlet or inlet

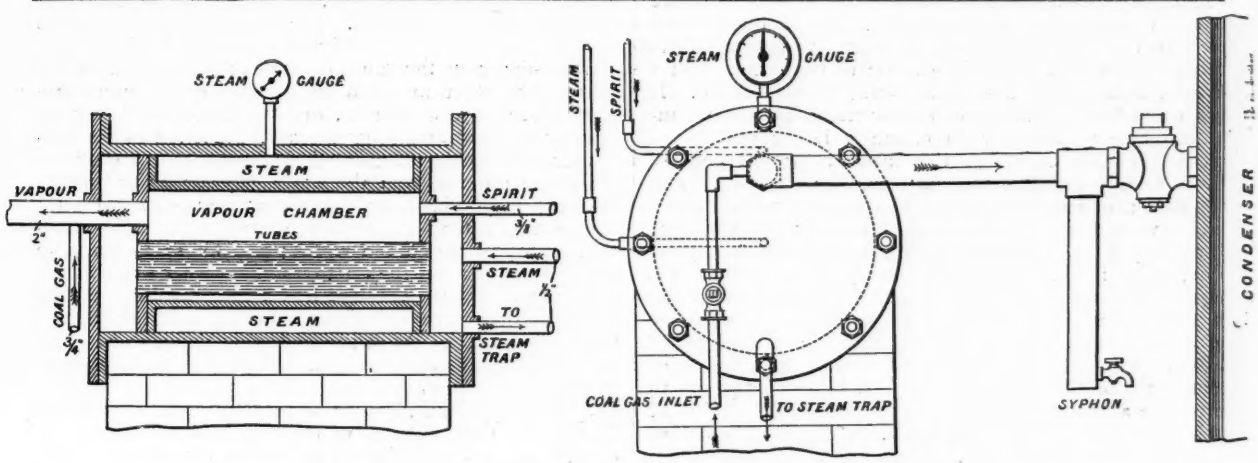


FIG. 4.—SPIRIT EVAPORATOR AT THE GRAVESEND GAS-WORKS.

of the condensers, he fitted up a small apparatus for this purpose. The evaporator was somewhat on similar lines to the Maxim-Clark apparatus, except that it required no injector and was fixed horizontally. It consisted of a cast-iron cylinder flanged, having a second one fixed inside, and fitted with tubes on the principle of a multitubular boiler, as shown by the sketch (fig. 4).

The spirit enters the top of the inner chamber, fed through a sight-feed and regulator from a small store-tank fixed about 8 feet above the level of the apparatus. The distance from the vapour-outlet to the condensers is about 30 inches; the pipe being 2 inches in diameter. A syphon is fixed on this short length of pipe, close against the condenser, to arrest any condensation of the spirit forming in it. The steam having been turned on, and the apparatus thoroughly heated, spirit was run into it; and this becoming vaporized, the vapour was pulled into the condensers by the exhaust vacuum. It was found, however, that in even this short distance considerable condensation did take place; nearly one-half the spirit vaporized being returned condensed through the syphon. But on introducing a stream of coal gas at a point close against the vaporizer, this condensation practically ceased. Up to the present time, the apparatus has not worked very successfully; but the author is still experimenting with it, and believes that eventually it will be found a very useful auxiliary to the Maxim-Clark machine—particularly in the summer time.

In conclusion, the author can testify to the great advantages gained by the Maxim-Clark system of enriching coal gas. He holds no brief for its inventors or manufacturers, but has simply stated his own experience with it. He has found the apparatus of such benefit and usefulness that he would be very sorry to be without it; for, leaving even economy out of the question for the moment, the simple advantage of being able to raise the illuminating power of the gas, 1, 2, or 3 candles at a few minutes' notice is inestimable, and could scarcely be done by any other method.

Discussion.

Mr. W. HARDIE, jun. (Tynemouth), said they must all have listened with great interest to these two papers on a most important subject. Mr. Glover's paper was particularly interesting. But he was not sure it could be very well discussed, as it dealt so much with theory; and he was not certain that he clearly grasped all the points which had been raised. It seemed to him that Mr. Glover's proposal was to use a portion of his carbonizing plant with high heats, so as to obtain a large quantity of poor-quality gas, and another portion of the carbonizing plant at a low heat, to produce good quality gas; and after the gas had passed the condensing apparatus, to mix them up for the purpose of giving a fair quality of good illuminating gas. He seemed to prefer this to high heats, and using two different qualities of coal—cannel coal and common coal—and getting the mixing done in the hydraulic main. He said that, with a poor quality of coal and high heats, there would be a considerable quantity of naphthalene given off. If this were so, and it were to be condensed alone, without any enrichment with cannel or something similar, there might be very great trouble in the condensing apparatus with this poor gas. In regard to Mr. Davis's paper, he had not had any experience in carburetting, because he found that, using a small proportion of cannel coal, he could get gas up to his standard—which was only 16 candles—at a very trifling cost. It was most interesting that Mr. Davis had taken the trouble to test these gases at the works and at a distance from them, so as to be certain that the gas enriched with carburine was of a permanent character. This was a question on which information had been wanting; and if Mr. Davis had satisfied himself that it was so, it was a great point gained. Another point which troubled many of them was whether the carburine did act as a solvent for taking out naphthalene; and as to this, there seemed a great diversity of opinion. It was satisfactory that Mr. Davis had so arranged his test that he had been able to convince himself that it actually did remove the naphthalene deposited in the gas. He did not understand

much about these carburettors; and as he was putting one up, he should like to ask how the gas was passed through. Mr. Davis mentioned that it was coupled up to the inlet and outlet of the gasholder; but as he thought the pressure was the same, he should like to know how the extra pressure was obtained to force the gas through the carburettor.

Mr. R. O. Paterson (Cheltenham), responding to a request to take part in the discussion, said he had not been able to fully grasp the whole of Mr. Glover's paper; but it seemed to him that he proposed, as a solution of the naphthalene difficulty, in so far as it effected the purpose of preventing the deposit of naphthalene, to wash the gas in a medium which would remove the naphthalene from the gas. But the liquid was supposed to be a hydrocarbon; and he was very much afraid that any attempt to wash gas in a hydrocarbon which was anything like the density of naphthalene, would have a prejudicial effect on the other constituents, and remove the lighter hydrocarbons from the gas. If he were right in this view, then they would have to ask Mr. Glover for some practical evidence that his suggestion was workable. He had also gone back to the producing plant, and mentioned certain facts in connection with the carbonization of coal which had a distinct bearing on the production of naphthalene. It was quite true that the modern system of gas manufacture had a tendency to create a larger percentage of naphthalene than was the case in the old days of lower heats; but this was an economic question. The production of gas at a higher temperature was effected with a view to obtain economical results; and he did not think they were justified in saying that because in getting economical results from the carbonization of coal at a high temperature, and thereby creating a larger percentage of naphthalene, they should go back from this economical position simply because the naphthalene difficulty had arisen. They should rather seek to find some means of getting rid of the naphthalene. Mr. Glover proposed to introduce a process which occurred to him at the moment as being very like what was called Dr. Eveleigh's system —a kind of oil-gas process. Some years ago this system possessed a great attraction for many gas engineers, and threatened to revolutionize the whole carbonizing arrangements. In this process, coal was carbonized at a low temperature, getting a large quantity of liquid products, and a small quantity of gaseous. Then, redistilling the oils or thin tar, a smaller volume of very rich gas was obtained; and mixing the two together, the inventor professed to secure a very fair average yield—something like 10,000 cubic feet of 20-candle gas—from the coal. Mr. Glover seemed to have hit on somewhat the same plan. Possibly mixing gas made at a high temperature with that made at a lower, might remove a great deal of the naphthalene difficulty. But then a non-economic operation was introduced, because the carbonizing of the coal at a low temperature and the re-gasifying of the liquid products would be a very expensive process—in fact, this was the rock upon which Dr. Eveleigh's system was wrecked. Mr. Glover gave a good deal of theory; and one was always glad to have theory stated, because out of it came new ideas. But he should like him to explain a statement which he could not understand: "The popular idea that hydrocarbonaceous substances which are soluble in each other yield vapours which also dissolve each other, and thereby help to keep each other in gaseous diffusion, is altogether erroneous." Mr. Glover said the reverse was the case—*i.e.*, that the popular idea was wrong, "for the very same conditions which enable the molecules of substance to dissolve in each other while in the liquid state, tend to keep them in the liquid condition, and prevent them assuming or remaining in the vaporous or gaseous state." This cut against his washing with liquid hydrocarbons of a density somewhat similar to that of naphthalene. The question of naphthalene was not altogether one of carbonization, nor altogether one of condensation, but partly of the material used. Yet at one works there might be no trouble with naphthalene; and in another, using precisely the same coal, there might be a great deal of trouble. It might be a question of carbonization or condensation, or both; but it was clearly not the fault of the coal itself. Then there might be another place where the reverse conditions prevailed; so that he could not exactly see that any particular process such as Mr. Glover mentioned was going to be a perfect solution of the difficulty, unless he put into his gas something like Peebles oil gas, or carburetted water gas, or used some enriching process. All these things were solutions, more or less, of the difficulty; but as Mr. Glover had gone to the heart of the thing, and began with the carbonizing plant, he had a great deal still to do before he could convince them that he had solved the problem.

Mr. A. Dougall (Tunbridge Wells) considered the paper of Messrs. Young and Glover was very interesting; and he was personally much indebted to them for the clear exposition they had given of the naphthalene difficulty. There was no doubt that the modern system of carbonization did increase the quantity of naphthalene produced, and thus gave rise to a great deal of trouble. He hesitated, however, to accept the methods suggested by the paper as being the best for dealing with these difficulties. There were several remedies. The first was the use of cannel producing less naphthalene and more liquid products, which took up the naphthalene and conveyed it safely to the tar-tank. The second method was that of condensation, to so conduct the process that the gas and tar should be kept together as long as possible, in order that the tar might take up the naphthalene. Unfortunately at the same time it took up other light-giving properties from the gas. If the object was to get rid of the excess of naphthalene, there were other methods which were easier than those suggested. Mr. Carpenter, of Vauxhall, had a way of dealing with naphthalene when it deposited in the condensers, by simply reversing their action, and making the outlet the inlet, so that the warm gas coming in contact with the crystallized naphthalene dissolved it. At Tunbridge Wells, they had always had this difficulty—naphthalene depositing on the works; and for some years he allowed the gas and the tar to travel together as far as the condenser. But they always had a considerable quantity of naphthalene deposited afterwards. At the present time, they separated the tar in the hydraulic main, and took it straight away to the tar-tank. Then the tar condensed in the retort-house main was led into the first portion of a St. John's apparatus, which was merely a series of washers. There the temperature was maintained at a uniform degree, and gas was allowed to bubble through this light tar. When it reached the condensers, they still had a very large deposit of naphthalene. He thought if naphthalene must be thrown down, the better way would be to simply reverse the connections, and let the warm gas dissolve the hydrocarbon, which would flow to the tar-tank. But he took it their object should be, not to throw this down and get rid of it, but to retain it in the gas. It appeared to him, therefore, that the third process suggested by the authors, of carburetting the gas by liquid hydrocarbon, so as to retain as much as possible, was the most satisfactory; for should the naphthalene condense, another hydrocarbon would also condense at the same time, and dissolve it. He was at present trying the process which Mr. Botley devised for spraying oil into the gas, but was not yet in a position to give any reliable data with regard to it.

Mr. J. W. Helps (Croydon) said, in being a visitor, he was somewhat in the same position as Mr. Paterson. He heartily congratulated Mr. Glover and Mr. Young on the matter brought forward in the paper, which he thought might be likened to a successful novel, inasmuch as they thoroughly succeeded in keeping up the excitement until the bitter end. It was not until readers reached the very last page, that they were thoroughly satisfied as to what the authors were aiming at. The point to be decided on this question of naphthalene was the one which Mr. Young had been bringing forward during the last year in the columns of the "Journal of Gas Lighting"—namely, as to whether it was possible, by the addition of hydrocarbons, to keep naphthalene in the gas to any greater extent than was due to the added gaseous volume, or whether it was only possible to prevent solid naphthalene deposits, not by keeping them in the gas, but by putting into the gas hydrocarbons of such vapour tension that, when the naphthalene deposited and dropped out, these liquids also dropped with them, dissolved, and carried them on, therefore, to the drip-wells. If this point could be thoroughly decided—and he must confess it appeared to him, at any rate from the theoretical point of view, that Mr. Young was right—the sooner it was done the better. Nine out of ten of those who adopted any form of enrichment, had also in view the object of preventing naphthalene deposits in their mains; and the general idea had been that, by adding carburine or cannel coal gas, they had been enabled to so alter the

vapour tension of the gas itself that they were able to keep the naphthalene in the gas. If this had not been the case, the sooner it was known the better, because annually many thousands of pounds were spent on attempts to do it when, according to Mr. Young's theory, it was impossible. He could not say much about the methods Mr. Glover proposed to adopt; but he agreed with another speaker that, if it were to be done, there were other ways in which it could be accomplished as simply. In some towns, the naphthalene difficulty never appeared; while in others, it constantly occurred. Was this due to the quality of the coal used even when carbonized at high temperatures, and the fact that no naphthalene was present due to the small amount of naphthalene in the hydrocarbons produced by that coal, or to the presence of large quantities of those hydrocarbons of vapour tensions approximating to that of naphthalene, which dissolved the naphthalene as it dropped down, and carried it to the drip-well? If so, was it a fact that a certain quantity of this hydrocarbon liquid, in which the naphthalene was dissolved, was discovered in the syphons, or was it found that the naphthalene, though it looked such an important matter in the solid state, when it was dissolved took up so little space that it was but little observable? With regard to Mr. Davis's paper, he would not take up time by saying much about it, except to congratulate him on his experiments. He (Mr. Helps) had had some years' trial with the apparatus, and could corroborate the statement made with regard to the cost of enriching; the figures given being almost identical with his own.

Mr. F. C. Cockey (Newport) said that he had been using carburine spirit for some time—more for the purpose of a naphthalene carrier. He should like to get some few suggestions as to the storage of this article, as he found considerable difficulty about it. It was such insinuating stuff to deal with, that it was exceedingly difficult to get a tank to hold it; and any light which could be thrown on this question would be very useful. The other day, he had a suggestion from a local official that they ought to have a licence to store it; and having looked up the matter, he thought there was no doubt that, under the Petroleum Act of 1871, a licence was necessary. The cost of a licence was not important; but there was a clause in the Act which gave the local authorities power to make bye-laws for the purpose of regulating the storage of petroleum. Of course, these bye-laws might be all right; and if the company were on good terms with the local authorities, there might be no difficulty in getting the licence in terms acceptable to the former. But if there was any friction between the two bodies, the local authorities might make such objections as would necessitate an appeal to the Secretary of State, who had power to consider the conditions, and allow special terms to be made for a licence.

Mr. S. Y. Shoubridge (Sydenham) said they were all more or less troubled with the naphthalene difficulty; and it would be a good thing if the Institute, or some District Association, could arrange to ascertain from the members the conditions which obtained at their various works—more especially those where no naphthalene was found, and also where it was particularly troublesome. It seemed a reflection on gas engineers that this trouble continued from year to year without their finding a solution for it. Some few years ago, a Committee was appointed by the Institute to collect information with regard to condensation. He suggested that a similar Committee be formed to obtain information from various works with regard to the naphthalene difficulty. It seemed to him there were hardly two works in which the same conditions prevailed; and if the information were obtained and collated, it would throw a good deal of light on the subject. They might then—with the assistance of the research work of Mr. Glover and others dealing specially with the subject—be able to find some satisfactory solution. With regard to the carburine process of enrichment, he could corroborate the experience of Mr. Davis. At the works of which he now had charge, it was in use; and he found the illuminating power, when tested at a distance of two or three miles from the works, was higher than at the works—proving, therefore, that, at a certain season of the year at any rate, the carburation was carried forward to this extent.

Mr. Davis, in reply, said the experience of the members with the Maxim-Clark apparatus seemed to be so unanimous, that there was little to refer to. In answer to Mr. Hardie, he might say that, in speaking generally of enriching on the inlet and outlet of the gasholders, he meant at a point near the inlet of the station meter, or near the inlet of the governors. As to the question of naphthalene, they had very little trouble with this at Gravesend. During the winter of 1891—which was very severe, and everyone almost was frozen out—they had nearly the whole of the streets in darkness, most of the public lamps being stopped up. But as the Corporation had these under their own charge, the Company could do very little in the matter; while there used to be some 200 to 300 lamps stopped every morning. In 1894, when the frost was far more severe, there were at the outside only some three or four lamps requiring attention; and he concluded, of course, that this was owing to the carburine spirit which was being used at the time, and which dissolved—or, at any rate, carried on to the burner—any naphthalene present in the gas, and so prevented its being deposited. The suggestion of Mr. Shoubridge was a very good one; and he quite agreed with it. It was very strange that in some works there was little or no trouble with naphthalene, while in others it was a constant trouble, even when using the same coals. If a Committee could be appointed to inquire, and a return be made from the various works, some conclusion might be arrived at to determine the trouble. He remembered in Bath, some 18 or 19 years ago, at certain times of the year the trouble with naphthalene was very bad. In whole streets the service-pipes were completely blocked. In one street in particular, which had two mains running through it—one a 12-inch and the other a 4 or 5 inch—a restaurant supplied by the smaller main through a 1-inch service-pipe was continually being stopped. The service-pipe was eventually taken out, and a larger one laid on from the 12-inch main. But in a few hours it also became stopped up; whereas at a house or two lower down in the same street, supplied from the smaller main, no trouble would be experienced, and the service-pipes would go for weeks without requiring attention. In another street, there were two services almost side by side, one of which would be continually stopping up, while the other required no attention at all. It was to get at the reasons for all this that he felt a Committee might be appointed. He thanked them for the kind way in which his paper—his first attempt at these meetings—had been received.

The President said he thought Mr. Davis was to be congratulated on his first attempt; and he was sure the Institute would be glad to have equally successful first attempts from other members. Before calling upon Mr. Glover to reply, he should like to throw out two remarks. One was with regard to the term high and low heats, which was rather indefinite. He thought it would be an advantage if they could state the temperatures more clearly. It would be generally agreed that each coal required a special temperature in order to obtain the best results. Those using carburetted water gas could testify to the advantage of keeping the heat as low as possible without sacrificing good gas, so as to reduce the amount of oil required; thus making a purer gas, and carrying forward the hydrocarbons which were in excess of what was required in the coal gas to maintain the illuminating power of the mixed gases. By watching this somewhat narrowly, they found that less oil was required than when a very high temperature was maintained in the retorts. The return in candles per ton of coal carbonized was greater than by working at very high heats. Economy was certainly realized when using water gas, by arriving at the temperature at which coal yielded its best candle value, and regulating the amount of oil to the illuminating power required. The other point he wished to mention was that the use of carburetted water gas had not cured the evil of naphthalene, though it had lessened it. Whether it might yet be found that this new oil gas would carry the naphthalene more efficiently than had been the case in the past, had to be proved; but using the proportion of oil gas which they had up to the present time, they could not claim to have cured the evil. It seemed to him that, not only ought they to keep an eye on the methods of manufacturing gas in the retort-house, but to consider whether a great deal did not depend on the methods of distributing it. It had been found, by taking careful statistics, that certain service-pipes when exposed deposited naphthalene at the exposed parts. This was no doubt attributable to changes in temperature in the pipes, and possibly in some cases to roughnesses on the internal surface of the pipes. This would

probably account for Mr. Davis's statements with regard to the internal surface. He cordially endorsed the remarks made by Mr. Shoubridge, that it might lead to very useful results if, before next year, some voluminous statistics could be gathered from the various works represented by the Institute.

Mr. GLOVER said he found himself in somewhat of a difficulty in having to reply for himself and his colleague; and he was sure they would all share in his regret that Mr. Young was unable to be present, on account of his health. He took up the subject as a matter of interest, and not so much because he was personally troubled with naphthalene. It naturally suggested itself that, if they had too much naphthalene in the gas, and if in the present state of knowledge it appeared impossible to retain the naphthalene up to the consumers' burners, even with the aid of enriching spirits, which added very little to the volume of the gas, they ought to take out the excess—and it was only the excess which need be taken out—to ensure the gas reaching the consumer without stopping up the mains. From this view they had approached the subject. One of the things which suggested itself was to deal with this excess by dissolving it out of the gas; and next came the question which was the cheapest solvent. Then the idea of carbonizing at two temperatures arose; and he might relieve their minds about that. Mr. Paterson raised the question about going back to an uneconomical method of carbonizing, and said they ought to find a remedy without returning to old-fashioned methods. This was just the point. Their idea was that from one-tenth to one-twentieth of the coal only need be carbonized at the lower temperature; and if the products of this part were added at the outlet of the condenser to the high-temperature gas, it would be found that the solvent naphthas from this low-temperature gas being poured on the high-temperature gas containing naphthalene would dissolve out the excess of naphthalene. This could be regulated, of course, by the relative quantities of coal carbonized at low or high temperatures. But it would be only necessary to carbonize one-fifteenth or one-twentieth of the coal used at the lower temperature; and when they remembered that the other portion could be carbonized at a very high temperature, to get the utmost yield of gas, he thought they would see that it would not greatly affect the average quantity produced from the whole of the coal. Another method of solving the problem was washing the gas from the excess of naphthalene; and Mr. Paterson would see that the difficulty he had mentioned had been provided against, as to removing the other hydrocarbons from the gas in addition to the naphthalene. They provided against this by suggesting that to the heavy oils used an enriching spirit—such as benzol—might be added, to prevent the abstraction of the lighter hydrocarbons which would otherwise take place. Another method suggested was the carburetting of the gas with a suitable oil, for removing the naphthalene by adding to the gas hydrocarbons which would condense out at the same moment that the naphthalene condensed out. It would be clear to their minds that naphthalene had the power of condensing straight away from the condition of a vapour to a solid state. In this way, it varied and differed from the other hydrocarbons. The other hydrocarbons went through the liquid stage; but naphthalene went straight from the gaseous to the solid. If they could get a hydrocarbon of the same vapour tension to condense out at precisely the same moment as the naphthalene did, they could have the naphthalene deposited in the liquid state instead of in the solid. Mr. Dougall referred to the difficulty of removing naphthalene from the condensing plant. They knew, of course, that by reversing the condenser, and making the outlet for the time being into the inlet, they increased the temperature and re-volatilized the naphthalene, causing it to go forward. There might be no difficulty about applying some of the suggestions they had made to remove the naphthalene from the condensers. The low-temperature gas, of course, could be put into the condenser at the point where the naphthalene would separate out, and thus prevent it separating in the solid form. Mr. Dougall said he preferred to retain the naphthalene in the gas. They would all prefer to do this, because there was no doubt they got considerable help in the illuminating power from the naphthalene, if they could keep it in. But if they could not, the best thing was to remove that which would otherwise separate out in the solid form. Mr. Helps said he would like to know why at some places they had difficulties with naphthalene, and at others not, though using the same coal, under the same conditions. The fact was they did not know all the conditions. But he would suggest that in many works they were in the habit of charging the retorts much more heavily than in others; and where very heavy charges were used, the gas had to pass through a mass of incandescent coke while the heart of the charge was still giving off its gases. The outside of the charge was thoroughly carbonized, so that the gas had to make its way through fissures in the coke. This was the time when naphthalene was being produced; and he had no doubt these troubles were much aggravated by the heavy charges used in some works. It also depended on the condition of the coal. When used very small, it induced the formation of naphthalene. There seemed an impression sometimes that the naphthalene was in the coal to start with; but this was quite erroneous. The naphthalene was not there until, under the conditions of carbonizing, it was formed by the decomposition of the hydrocarbons; and it could be obviated to a large extent by the method of charging the retorts. He could not reply fully to the question raised by Mr. Paterson about vapour tension; but he had no doubt Mr. Young would avail himself of the new rule of the Institute allowing members to take up the discussion afterwards, and further elucidate the points which he had failed to make clear. He might say also that, though he had co-operated with Mr. Young in this matter, that gentleman had done the "lion's share" of the work.

THE AUTOMATIC REGULATION OF PRESSURE IN THE DISTRIBUTING MAINS.

By WILLIAM REGINALD CHESTER, M.Inst.C.E.

There was probably never a time in the history of gas manufacture when an improvement in mechanism tending to higher results, either in the manufacture or in the distribution of gas, met with a more cordial and general welcome than it does to-day. Every gas manager is on the *qui vive* for some improvement which will carry him a step further in advance, which will enable him to forge ahead, and still further widen the distance that already exists in the race for popular favour between gas and its keenest competitors. We have not much to fear; but it must always be borne in mind that some of the best engineering intellects in the world are ever busy in improving and developing the mechanism by which our most formidable rival, the electric light, is produced, and that we must be on the alert to every improvement in gas manufacture and distribution if we are to keep our position in the race.

It is in the manufacturing plant that the widest scope is offered for effective invention, and where probably the greatest gains are to be obtained. But anything which tends to give the consumer a more satisfactory supply and a better individual control over his consumption is as much to be sought after, and is as certain to bring its due reward, as though the actual gains could be set forth in money value, as they usually can be when the improvement is in the productive portion of a gas undertaking.

It is an instrument for effecting this purpose that I am about to describe, and which I have had in practical work for rather more than six months. The results of its working cannot be fully stated in £ *s. d.*, because the whole of the data for judging are not available; but they undoubtedly trend in the direction of economy, and as assuredly carry us a step further than we have hitherto been able to go in the direction of increased efficiency and better control in the distribution of gas.

An ideal condition of things in gas distribution would be that the gas throughout the whole district of supply should be delivered on the outlet side of the consumer's meter at say 10-10ths pressure, so that he might burn it under the most advantageous conditions for obtaining the maximum light from the gas. This condition of things can, however, never be more than ideal, as a few moments' reflection will show.

Let us assume that we have to-day a perfect condition of things in which the mains, services, meters, and the fittings right up to the consumers' burners are all of adequate size for passing the maximum quantity of gas required, and that the district is one having a slight inclination in an upward direction, with just sufficient rise to

DIAGRAM I., SHOWING PRESSURES AT GOVERNOR AND AT RADCLIFFE BEFORE ELECTRICAL APPARATUS WAS PUT INTO USE.

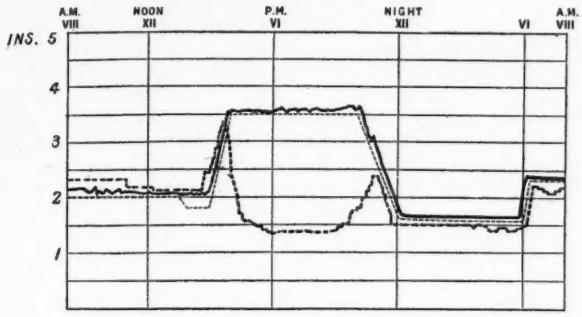
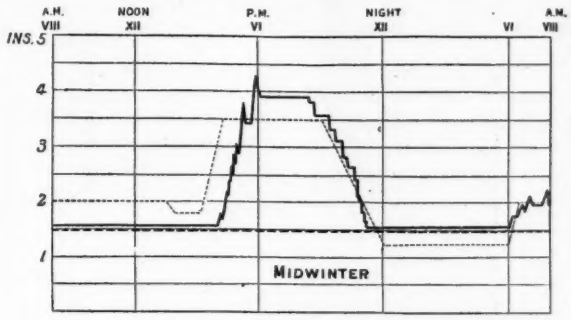
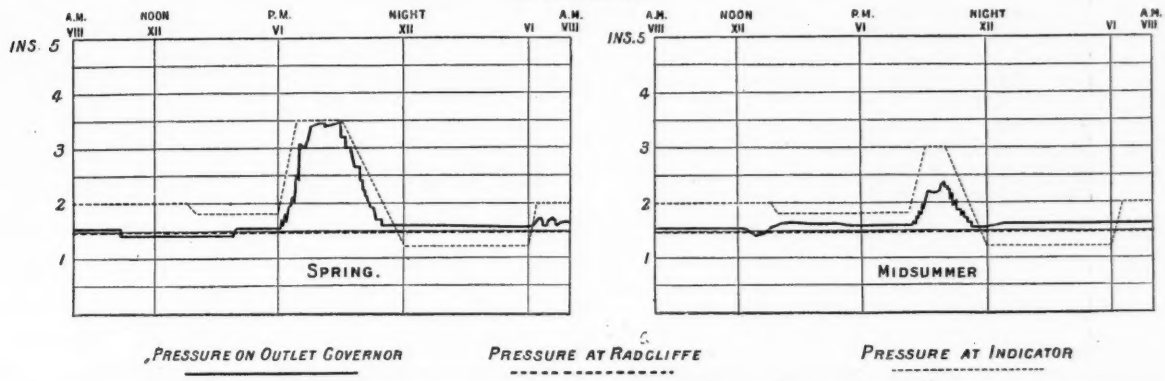


DIAGRAM II., SHOWING PRESSURES AT GOVERNOR AND AT RADCLIFFE WITH ELECTRICAL APPARATUS IN OPERATION.



DIAGRAMS III. AND IV., SHOWING PRESSURES AT GOVERNOR AND AT RADCLIFFE WITH ELECTRICAL APPARATUS IN OPERATION.



overcome friction, we shall then require to send out the gas only at one constant pressure from the works to insure every consumer getting as much as he requires, and getting it under conditions best calculated to yield him the maximum of light for a minimum consumption of gas. But though it might, under very special circumstances, be possible to effect this condition of things to-day, the balance would be upset to-morrow by coupling up the mains to a new consumer, by an existing consumer adding another burner to his fittings, or by him purchasing and fixing a gas-fire, or hiring a cooker; and thus the balance between mains and consumption which may exist at any one particular time is continuously being upset, and always in the direction of the consumption, which means that, from the day they are laid and fixed, mains, services, and meters become less and less adequate to cope with the demands made upon them, and one of two things must happen—either the consumer will not get sufficient gas for his requirements, or the gas must be delivered at a higher initial pressure from the works in order to counteract the friction due to the increased volume of gas the mains are called upon to pass. As the consumption outgrows the capacity of the meter, it is an easy matter to replace this with a larger one. But it is only as a last resource that fittings, services, and mains are interfered with to bring them up to the requirements of the case; and then only are they touched when it is no longer safe to still further increase the pressure at which the gas is sent out from the works.

As an illustration of how this increasing demand outgrows the capacity of mains and services, I have had a diagram prepared, marked No. 1, which shows the present initial pressure at the works and that at the end of the district of supply, about six miles from the governor. It will be noted that at the periods of minimum consumption the pressures are nearly equal at the works and at the extremity of the mains, but that when the full draw is on a pressure of 35-10ths at the works yields only 14-10ths at the far end, thus clearly indicating inadequacy in the size of the mains.

Complaints as to deficient supply in this district were more numerous than in the writer's opinion they had any right to be, considering that the minimum pressure apparently never went below 15-10ths, and when the complaint was investigated it was always found that at the particular time of trial there was sufficient gas to satisfy the consumer. The deficiency no doubt arose at periods of extraordinary demand, only occurring at intervals, and of short duration, but always sufficiently long to produce a crop of complaints and the accompanying irritation to both consumers and suppliers of gas.

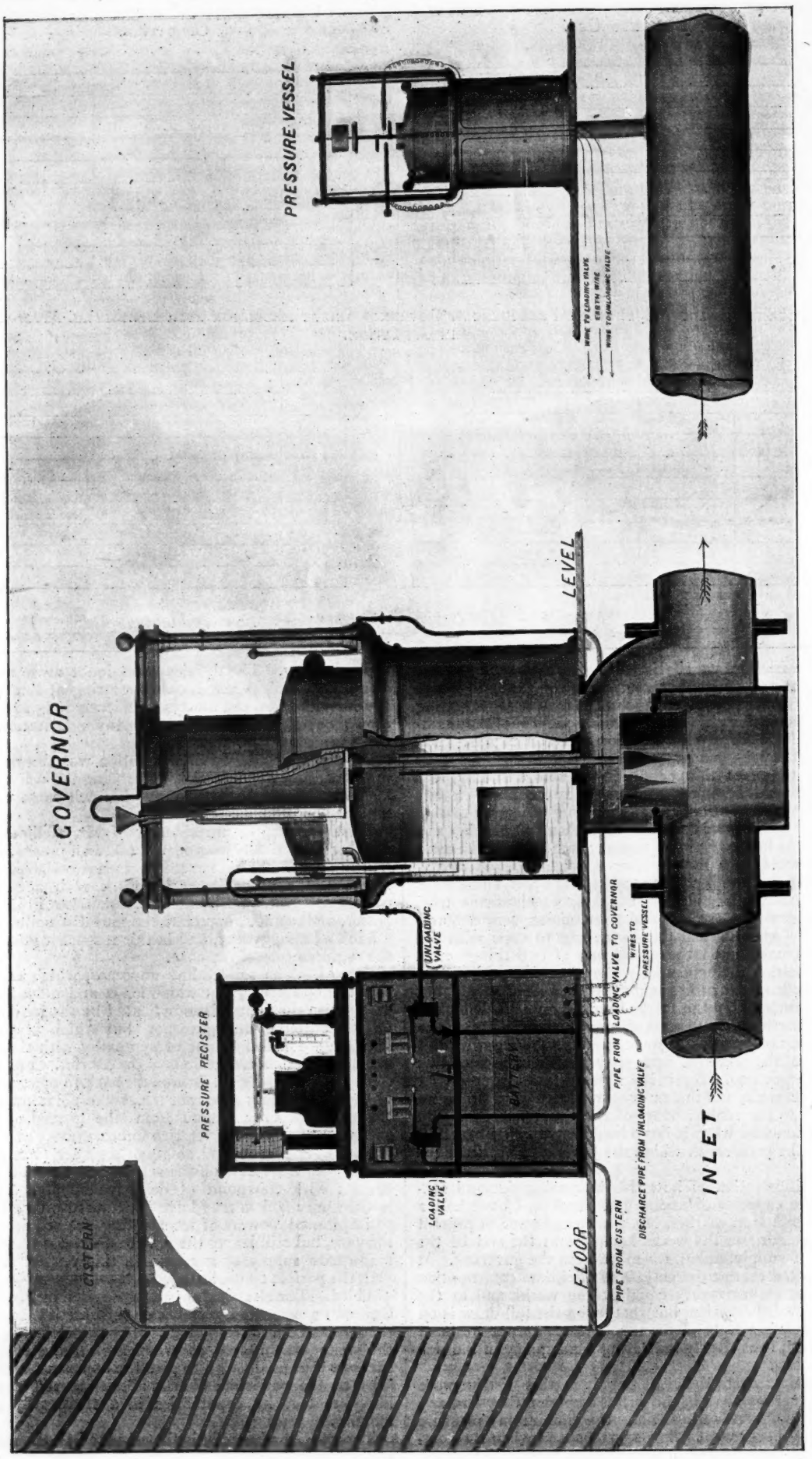
At this time the writer's attention was drawn towards appliances for automatically controlling the delivery of gas from the works, three systems of which came under his notice.

First.—The pressure changer of Mr. William Cowan, which automatically puts on and takes off pressure at fixed stated times. The instrument is a wonderful piece of mechanism, and performs its work with accuracy and precision. But, unfortunately, it is deficient in intellectual power, and cannot appreciate the nice distinction between a fine and a foggy day, and in this respect it falls short of the requirements of the case.

Second.—The self-loading governor, which carries the case a step further, and which loads and unloads in sympathy with the demand, as indicated by the local pressure on the outlet of the governor, but which at periods of maximum demand is out of sympathy with the requirements of the remoter portions of the district. For between the point where the gas is brought back to operate the bell of the self-loading governor (*i.e.*, some point on the outlet main not very remote from the governor) and the extremity of a long district, two forces, gravity and friction, come into operation, and, singly or together, form a barrier which effectually cuts off the self-loading mechanism from contact with the point of defective supply. The self-loading mechanism may have done its work perfectly up to its limited powers of interpreting the requirements of the case, but still leaves the remote district with an utterly inadequate supply of gas, and in this respect it fails to give the perfect control needed.

Third.—The electrical apparatus devised by Mr. William Cowan, an esteemed member of this Institute, then presented itself for investigation. The principle appealed to the writer so strongly, as promising all the elements of success, that he decided to give the apparatus a trial, and selected the particular district above referred to as being likely to test its capabilities in a thoroughly effective manner.

The district of supply is that situated on the south side of the River Trent, and embraces the suburban residential villages of West Bridgford, Cotgrave, Gamston, Holme-


PRESSURE VESSEL
WIRE TO LOADING VALVE
EARTH WIRE
WIRE TO UNLOADING VALVE
GOVERNOR
LEVEL
UNLOADING VALVE
PRESSURE REGISTER
BATTERY
LOADING VALVE
PIPE FROM LOADING VALVE TO GOVERNOR
WIRES TO PRESSURE VESSEL
CISTERN
FLOOR
PIPE FROM CISTERN
DISCHARGE PIPE FROM UNLOADING VALVE
INLET

Pierrepont, and Radcliffe-on-Trent. The united consumption is 31½ million cubic feet per annum, and the gas is supplied through an 18-inch William Cowan's patent governor and a 16-inch main for the first mile of its length. The main is afterwards reduced to 9 inches and 6 inches, the latter size pipe being carried to the extremity of the district, which is rather more than six miles from the governor. As indicated on diagram No. 1, it is palpable, from the fall in pressure between the governor and the extremity of the district, that at the period of maximum demand the smaller main is inadequate for the proper supply of the district and must soon be enlarged; but in this respect it served the useful purpose of imposing as severe a tax upon the apparatus as it is ever likely to be subjected to.

The apparatus consists of the following parts:—

I.—A William Cowan's patent governor, fixed in the ordinary way at the gas-works.

II.—A pressure vessel, fixed in a convenient building at the extremity of the district, protected from frost.

III.—An electrical apparatus, fixed in the governor-house, for operating the valves which load and unload the governor bell.

IV.—A water tank, coupled up to a constant supply of water and fed through a ball-tap.

V.—The connecting wires coupling up the pressure vessel at the extremity of the district to the electrical apparatus controlling the loading and unloading valves in the governor-house.

The working of the apparatus is as follows:—

The electrical portion fixed near the governor consists of two sensitive relays which are operated by ordinary Leclanché batteries, the number used being in proportion to the distance the district requiring regulation is away from the governor, and also upon the time required to put on or take off the pressure. Each relay is a form of horse-shoe electro-magnet.

Immediately an electric current is sent through the magnets they draw a regulated armature of soft iron up to their two poles. These armatures are fitted with platinum contact pins to come into contact with platinized springs or points. When these contacts are made powerful local currents from a larger primary battery are sent round the coils of other larger electro-magnets, which draw up the soft iron armatures attached to the water-valves, thus opening them and allowing them to remain open until the current through the relays is broken.

The making and breaking of the current is done by a second piece of apparatus attached to the pressure vessel fixed at the extremity of the district. This pressure vessel consists of a tank and floating bell or gasholder balanced by the gas pressure. Upon the bell a pair of arms are set and fixed, but they are electrically insulated from the metal forming the bell by ebonite, mica, asbestos, or other suitable insulating material. These two arms constitute one end of the return wire, through which current is passed to the two relays near the governor.

On the tank of the pressure vessel two adjustable and pivoted arms are fixed, electrically insulated from any metal and from each other. These two arms are the two ends of the two main line wires connected directly to the two relays. All the arms are arranged so that it is impossible for more than one fixed and one pivoted arm to come into electrical contact.

The operation is, that as soon as there is a demand for gas sufficient to alter the balanced bell of the pressure vessel the bell falls, allowing one fixed and one pivoted arm to come into contact, immediately closing the only broken part of the electric circuit. A current instantly passes from the relay battery through the relay controlling the supply valve, along one of the line wires to the pivoted arm in connection, across this arm to the fixed arm, through the return wire, back to the battery. As soon as the relay receives current its armature is drawn up, closing the powerful local circuit for operating the supply valve, which then opens and supplies water for loading the governor until the pressure at the distant end is brought to the standard pressure desired, when the circuit is broken, releasing the armatures of the relay and valve magnets, and closing the loading valve of the governor.

As the demand for gas decreases, the bell rises and brings the other fixed arm into contact with the other pivoted arm, sending the current along the other line wire through the relay, &c., operating the syphon or unloading valve of the governor, and allowing the water to run off until the pressure of the gas at the pressure vessel has again been reduced to the standard fixed.

The constant pressure to be maintained at the far end of the district was fixed at 15-10ths, this being ample for all requirements either at daylight or dark, and as will be seen from the diagrams Nos. 2, 3, and 4, this pressure of 15-10ths is maintained with perfect regularity throughout the twenty-four hours. Diagrams have been taken each day at the works, at West Bridgford, and at Radcliffe, since the apparatus was started; and as illustrating the actual working of the instrument, the writer has selected pressure papers taken at periods of the midwinter, spring, and midsummer consumption.

The instrument acts with perfect regularity whatever the draft on the mains may be, and responds to every change in the demand with absolute precision. It is pretty to watch the operation of taking on pressure at lighting up time, to note the intimation passed to the governor that another burner has been lighted, to see it immediately respond to the additional demand, and then note the closing of the valve directly the requirements are met. It is immaterial whether the demand be temporary, such as is due to a passing cloud in the daytime, whether it is sudden, or whether it comes on gradually, as when one burner after another is lighted up the governor is always equal to the occasion and performs its function with automatic precision, never allowing more pressure in the district than is required and never permitting an insufficient supply of gas, so long as the gasholder pressure behind the governor is in excess of that needed to maintain the standard at the far end during periods of maximum demand.

It will be observed on reference to the diagrams 2, 3, and 4, that the minimum line of works' pressure, needed to maintain the standard is for the greater part of the daylight hours less than that of the indicator line fixed for working the governor by hand, and that at certain periods of maximum demand it is greater than the indicator line. In the former case the reduced pressure means reduced leakage over many hours of the year, and in the latter case it means that the consumer is not cut short of his full requirements just when he needs the gas most.

To measure the full economical aspects of the instrument is scarcely possible, for the results will vary with the varying consumption of gas; but to take the case of this particular installation, we have over the whole of the gas area a loss from unaccounted-for gas of a little less than 6 per cent. Let us suppose that the diminished pressure effects a saving of 2 per cent.; then the saving on a total consumption of 31½ millions will be 630,000 cubic feet of gas per annum, or £80 worth, calculated at the selling price of gas.

Whatever the saving in leakage may be, whether much or little, and it must be one or the other, this is only one incident in the favourable working of the apparatus—a far more important one being, in the opinion of the writer, the guarantee that under all circumstances and at all times the consumer will get a sufficient quantity of gas, whether his requirements are great or small, and that the supplier of gas will never be called upon to deliver it except under the most advantageous conditions to himself.

A drawing of the whole apparatus has been prepared; but, in order to make the electrical portion quite clear, the writer has asked Mr. Cowan to supply a model which will be operated before the members.

Discussion.

Mr. Isaac Carr (Widnes) said all were interested in this important question, and were much indebted to Mr. Chester for the clear manner in which he had explained this beautiful and ingenious arrangement. In working an apparatus of this description, one or two questions cropped up. Most of them were familiar with the telephone, and the vagaries that attended the working of this apparatus; and the question arose whether the same difficulties would not occur with this arrangement, where there were five or six miles of line—difficulties arising from thunderstorms, mischievous little boys with slings, the carelessness of the electric light men dropping wires in the course of repairs on to the other wires, and so on—and whether these would not put the governor in and out of action at times when it was not required. Mr. Chester could probably tell what these inconveniences amounted to in actual practice.

Comparing the Radcliffe line on No. I. diagram with those on the other three diagrams, it showed that a very desirable result had been achieved. Was it possible by the apparatus to vary the pressure on an extended district? Although a regular 15-10ths was shown on the third diagram, it might in many districts be desirable to have the pressure greater or less than this; and he should like to know if it could be increased or diminished, if so desired. Many of them had had experience in self-loading governors; and they all knew how desirable it was to make these appliances automatic, where possible. With one type of self-loading governor he knew, in some towns, and under some circumstances, the apparatus was perfectly automatic, reliable, and sufficient; and he should say that where such conditions could be obtained in a self-contained apparatus, it was to be preferred to this additional complication. But his own experience of the self-loading governor had not been quite so happy. For reasons he could not explain, he had not been able to make the governor work at Widnes. There must be something peculiar in the size or capacity of the mains, different to the conditions obtaining in other towns where it operated satisfactorily; and probably the same might be said of this apparatus. Without a doubt it was pre-eminently suitable for this particular locality; but at the same time, he would observe that on diagram No. II. the additional pressure at the outlet of the governor was in excess of the additional pressure on No. I., prior to the introduction of the apparatus. However, the result was highly satisfactory; and if the apparatus could be made to vary the pressure according to the requirements of any outside district, he should think that it would be a very valuable invention.

Mr. D. Irving (Bristol) did not know of anything more troublesome to those in charge of gas undertakings than the constant complaints of defective supply. In his own experience, these causes of complaint were to a large measure due to the fact that a proper pressure was not maintained in the several districts; and any apparatus that would tend to give sufficient pressure and a regular supply of gas in outlying districts, must be very welcome. Mr. Carr was the very last gentleman in the gas profession whom he would expect to raise any objection to an improvement because it might possibly entail some difficulties; for Mr. Carr was a gentleman so full of energy and push, that troubles and difficulties were understood to be nothing to him. There was one thing which he (Mr. Irving) firmly held—namely, that if any gas engineer was afraid of trouble, and wished to have things comfortable and to have no bother, let him sit still and do nothing; do not let him touch this or any apparatus aiming at improvement. But if they wanted to improve, as far as they could, they should examine every proposition fairly on its merits; and if a good case was made out, they should have the courage to adopt it. He was afraid, as a profession, they were apt to be too conservative. He had had the pleasure of seeing this apparatus at work in Carlisle; and he could testify, from what was shown to him, that it answered everything that could be expected of it. No doubt there would be difficulties with wires; but if they were not prepared to take some trouble to give an ample and regular supply to their consumers, they would fail in their duty.

Alderman Miles (Bolton) said this appeared to be an apparatus applying to one particular district of supply, without regard to any other district. In other words, the apparatus would only be suitable in the case of a main leading from the governor to a particular district. Now a great many works were not in this position, but they had one or more governors to every two or three stations; and these were in connection with each other, for the purpose of regulating the supply throughout the whole district. While the paper was being read, he was thinking how the apparatus would answer in a case of this kind; and he could not make out that it would do so at all. Again, he presumed in this case Mr. Chester had been careful to have his mains of sufficient capacity to give a full supply to the district; but when the pipes were getting to be a little too small—which was the regular case in all gas-works—there would be a point at which it would be impossible to manipulate the supply as he wished. If the mains were large enough this year, the consumption on some portion might become so large next year that they would be a little too small; and what would be the effect in such a case? He was surprised to hear of a pressure at the initial point of supply of 4 inches. He thought they were accustomed to 2-inch pressures; and this seemed very high, unless under peculiar circumstances. He believed they were all taught to keep the pressure as low as possible, and get as great a volume of gas as they could.

Mr. C. A. Craven (Dewsbury) said that he had some experience of automatic pressure-regulators; having used the one made by Messrs. J. and J. Braddock for the past two years. It must be a great comfort to a manager to know that, whatever climatic changes might arise, the pressure was always being attended to. Before they put in his regulator, the men used to make about twelve or fourteen changes per day; but now they did not need to go near the place at all. He had with him a diagram taken in the early part of the month; and he found that, when thunderstorms passed over the district and it became very dark, though no one went near the governor at all, the pressure was put on by his very simple and accurate little machine, and kept on for about an hour. When it became bright again, the pressure was taken off automatically. This had occurred twice in the present month. His experience, therefore, was entirely in favour of automatic regulation.

Mr. J. Stelfox (Belfast) said he should like to ask two questions, one of which had been already put by Alderman Miles. In any arrangement of this sort, with an automatic adjustment, were you not bound to a certain pressure? When the pressure was once set, must you not be satisfied with that? This had always been a difficulty with automatic regulators. Alderman Miles had referred to the old rule of keeping the pressures as low as possible; and so they wanted to do. They were obliged in mid-winter to give 4 inches, which was the maximum they could furnish. If they could manage sometimes to give another 5-10ths, they would be glad, because the mains were so taxed at certain parts that pressure had to be put on in order to reach them. He took it that if the regulating vessel were fixed for 15-10ths, they would not have the control over the district which would be necessary if they required, say, in half an hour to increase the pressure from 12-10ths up to 4 inches. He could easily see that, by altering the balance of the pressure vessel, it might be made semi-automatic. But if it had to be adjusted by hand at all, it seemed to him almost as well to adjust it entirely at the governor-house. He thought also the working of these automatic appliances depended on the perfect districting of the gas-mains of a town. He had given a trial to the beautiful automatic pressure-changer of Messrs. Cowan; but he was obliged to give it up, because there were two governors on the main, and consequently the thing would not work. He had had a conversation a short time ago with Messrs. Braddock, in reference to their automatic changer; and it was admitted that, if the mains were not districted, it would not work. In his case, they had tried to arrange the mains as much as possible after the model of the circulation of the blood; so that, if one portion of an artery became clogged, it would be supplied from another district. If a district were distinctly separate, he could believe that this automatic appliance would work perfectly; but in his own case on one side of the river they had four governors, the mains connected with each branching off to a particular district. These mains were, however, all connected to each other by branch mains, so as to form a regular arterial system. He should like to know if Mr. Chester would consider that, under such conditions, the apparatus could be effective.

Mr. H. Tobey (Malton) complimented Mr. Chester on the very clear demonstration he had given of this ingenious apparatus. He claimed that it would result in a saving of leakage, which he had pretty clearly shown by diagrams. It would be noticed that the line of initial pressure at most seasons of the year was below that which would have been given in the ordinary method of working by the man in charge of the governor. But Mr. Chester had not claimed for the apparatus another benefit which he might have done—viz., not only a saving of the leakage, but a saving in capital outlay. On diagram No. II. the pressure ran up to about 44-10ths. This only lasted a short time; but had it not been given, the consumers in the district might have complained, and these complaints might have led to a large expenditure in new mains to supply the lack of pressure. But when they saw from the diagram that this demand only lasted for a very short time—say, about a quarter of an hour—they would not be

disposed to spend money in new mains, when the matter could be met by an increased pressure for these few minutes. This apparatus raised the pressure just when it was wanted; and they might be willing to give a high initial pressure for those few minutes, in preference to spending more money on new mains.

Mr. J. Laycock (Keighley) asked if Mr. Chester could tell them what would occur in the case of a storm blowing the lines down, and so making contact with earth. The same result, of course, would occur when the telephone companies' men, in fixing their lines, happened to draw one across his line. He had had some experience with electrical signalling apparatus in connection with the Corporation fire brigade; and he found that occasionally the brigade was called out by the telephone company's men drawing a line across the alarm wires. They insulated the wires; but unfortunately these accidents still occurred occasionally. He could imagine that in winter time, when wind and snow storms were most frequent, the wire might come down, and take the pressure off when it was most required.

Mr. W. Whatmough (Heywood) said he had had experience of self-loading apparatus in their works for over two years; and it was most satisfactory. There was very little trouble with the apparatus; and the pressure was put on in a similar manner to that indicated in the diagram shown by Mr. Chester. The first cost was small; and the leakage during the period referred to had been reduced 2 per cent. He should imagine that the first cost of apparatus such as that now described would be very large; and he feared it would require much attention. It would be interesting if Mr. Chester gave the cost of the arrangement.

Mr. E. H. Millard (Durham) said that Mr. Chester had omitted some claims for this apparatus which he might have added, and included others not due to the governor. It was evident that the extra 5-10ths pressure required at maximum consumption, if put on by hand, would have answered as well as if put on by the automatic apparatus. One point Mr. Chester omitted was this: Looking at the regulation line for the men to load by hand, it would be found that the pressure was always put on before it was wanted. When he adopted a self-acting water-loading governor, he was very much concerned for a night or two because the governor would not load at the time that they *thought* it ought to. Afterwards, from diagrams taken in the district, he found that this was correct. Diagram No. II. certainly showed the pressure on an hour behind the time when one might imagine it ought to be put on. But if the pressure were put on, and was there waiting for the consumers, then the burners when first lighted were bound to roar, and the consumers would be inclined to check them in the early part of the evening; and afterwards, when the pressure dropped, they might not re-regulate the burners to the altered conditions, and consequently complaints would be made of a deficient supply. This no doubt explained many of the complaints which arose. In the case where the pressure was just put on as it was actually required, the consumer would not need to check his gas, and consequently the burners would not require re-regulating; and the result would be a largely increased consumption. The length of wire was rather alarming; but he should imagine that it might be got over with a self-loading governor, if it were known what load was required at the maximum period by an ordinary automatic governor without wires.

Mr. R. Porter (Elland) said he had had some three years' experience with water-loading apparatus, in connection with district governors; and he found the saving was not so large as was expected. One difficulty he had to contend with was the rate at which the apparatus loaded the governor. When the mills came on at night, they required gas immediately, and must not be kept waiting; and this self-loading apparatus put it on so slowly that it took twenty minutes to load. He thought the saving that Mr. Chester claimed on a make of 31½ million cubic feet was excessive. He claimed a saving of 2 per cent. leakage, which he worked out to £80 at selling price. If he took this at the cost of the gas put into the holder, he would find it very materially reduced. The apparatus described would require a very considerable amount of attention. He found that with very crude methods, the water acted on the brasswork of the valves, and they required attention; and if this were put down in £ *s. d.*, there would be a large reduction in the saving claimed.

Mr. W. D. Child (Romford) said he had had some five years' experience with automatic pressure-changers, and had at all times found the instruments reliable. He was therefore pleased to learn that further efforts were being made, not only to effect the changing of pressure automatically, but on a more perfect system. He did not think it was desirable to put on excessive pressure at particular times to increase the carrying capacity of the mains, in the belief that they would in this way accommodate their consumers, because they were hardly able to know what was really required. Even if they went to the greatest trouble by taking pressures at the extreme end of the district, and finding what they believed to be the proper pressure to send out from the works, circumstances might occur which after all would leave some with an imperfect supply. In his own town, in one district they supplied two very large consumers on the line of main; but he could not say whether the factory would be running their gas-engine or lighting up an extra workshop at any particular time. Therefore if they took the pressures one week, and determined that 25-10ths at the works would be sufficient to give 15-10ths or 16-10ths at the extreme end of the district, on the very next night some extra apparatus might be employed, and the calculation would be thrown out altogether; and he would probably be annoyed, in the course of two or three days, by receiving complaints from consumers at the end of the main that they were not getting the pressure they wanted. He thought that the perfecting of this instrument, so that it would maintain a constant and regular pressure at the lowest part of the district, irrespective of the demand being made upon the pipes, was exactly what was wanted; and he believed Mr. Chester would find that, no matter what little trouble might be involved in keeping the apparatus in order, it was the right step to take.

Mr. W. Sugg (London) congratulated Mr. Chester on this very simple apparatus. A good many years ago, he used to attend to the regulation of pressure at Greenwich from the South Metropolitan Gas-Works in the Old Kent Road; and it seemed to him that Mr. Chester had done the very thing which was wanted at that time, and, he should think, still more so now. Greenwich being a considerable distance from the Old Kent Road, one could not always tell what was going on. Sometimes, if a heavy cloud came over Greenwich—which often happened—the pressure, if one did not look after it very sharply, would suddenly drop exactly as in diagram No. I. This had been repeated more than once. He had known it drop even lower; but with Mr. Chester's apparatus, this was avoided altogether, because the moment the supply was deficient, the electric apparatus loaded the governor and increased the pressure. This was beautifully shown in diagram No. II. The pressure was obviously regulated to a nicety, which could not be done formerly unless one had a man constantly at the valve. The actual wants of the district were accurately shown, and immediately attended to. Someone said the apparatus seemed complicated; but there was really no complication at all. The armatures, by the click they made, showed they had a considerable pressure upon them; and if there were any little friction in the working, this would overcome it. But there was no difficulty in increasing the length of wire in the armatures; and one could get power to raise ½ cwt. if necessary. With regard to the contacts, of course they might fail, and they did sometimes. But this could be attended to once a day; and there was very little chance of them getting out of order. Any distance one had to go with the wire was a mere nothing. It was only low-tension electricity. There was no loss in passing through the wires; and if there were, all that was necessary was to make the batteries a little bit stronger.

Mr. Chester, in reply, said it had given him great pleasure to watch during the last five months the way in which this apparatus had accomplished the work it was intended for, which had been in the highest degree satisfactory. Wherever there were electric wires, there would be sure to arise at some time or other little difficulties in connection with contacts, high winds, or mischievout youngsters who flew kites; or troubles by lightning mighs occur at one time or another. But their action was only limited; and the moment anything got out of order, a man was told to go down the wires, find out where it was, and put it right. It might arise once, twice, or three times a year. But it was a very small matter, easily rectified;

and once the wires were laid in a satisfactory way, there was not much cause of trouble. In case of the electrical portion of the apparatus being thrown out of operation by a contact, or troubles of that kind, it would not interfere with the hand working of the governor. They simply switched off the connection, and the governor was then operated exactly as before—*i.e.*, the loading and unloading was done by hand. The question had been asked whether it was possible to vary the pressure at the extreme end of the district if the necessity arose. This was a very simple matter; it was merely a question of weighting, or taking weight off, the pressure vessel. One could fix 4-10ths, 5-10ths, 10-10ths, 15-10ths, or 20-10ths, or anything that was desired, so long as there was sufficient pressure at the works to overcome friction in passing the gas along the main. The district pressure could be fixed at any maximum or minimum that was thought proper; and it could be varied by the simple process of putting on or taking off weight at the balancing-vessel. Alderman Miles asked if it was an apparatus suited for one special district. In the present case, it was applied to an isolated district on the south side of the river, and was cut off from all districts on the north side. So far as districting was concerned, he endeavoured to separate all low-lying districts from the high-lying ones. Though the mains were in a sort of arterial condition when he went to Nottingham, he had gradually altered the system, so as to have high-level and low-level supplies, and thus reduce the average pressure at which the gas was sent out. The town of Nottingham was hilly; and with a pressure of 10-10ths at the works, in some parts they got as high as 5 inches in the daytime, and probably 4½ inches at night. In the particular district referred to, the pressure was never less than 4 to 5 inches. He might add that the pressure at which the gas must be sent out from the works must entirely depend on the requirements of the district remote from the works. In some cases, it was necessary to send it out at as high as 7 inches. The reason for this was, of course, the gradual outgrowing of the capacity of the mains, which was taking place from day to day, and went on from year to year until they came to a point when it was absolutely necessary to enlarge the mains. In this district, being an undulating one, they had to supply a pressure of 7 inches at the works in order to get 10-10ths at the other end. The self-loading apparatus of Messrs. Braddock had been referred to by some speakers, and, he thought, with satisfaction as to its results. But the difference between that apparatus and this was that its control was local. It was actuated by the pressure at the outlet of the governor or at some point only a short distance away from it. But, as he had indicated in the paper, the force of gravity and friction coming into operation put the loading appliance entirely out of sympathy with the requirements at the far end of the district. This effect was shown clearly in diagram No. I. The apparatus was then loaded by hand, or it might have been by some automatic control, such as Braddock's, in the near neighbourhood of the governor. But when the consumption came on at any time, though the governor was loaded in due course, the supply of gas was out of all sympathy with the requirements at the other end of the district. The pressure in the district gradually fell down to a lower point than the day pressure, when the maximum consumption and the maximum pressure was on at the works. In the case of diagram No. II., the pressure in the district was regular all through the twenty-four hours, and the pressure at the gas-works was increased just in proportion to the requirements, so as to give 15-10ths at the far end—no more and no less at any time. In fact, the machine acted with the most perfect intelligence; just giving the pressure when necessary, and taking it off when not required. Mr. Stelfox thought the advantages of an automatic apparatus were only limited; and that if it would only do what a man himself could do, the man might as well do it as the apparatus. But unfortunately a man at the gas-works, be he never so intelligent, would not know what were the particular requirements all over the district of supply; and therefore could never do exactly the right thing at the right moment, as this instrument did. Mr. Stelfox also suggested that the arterial system of supply—that was, having all the mains coupled up—was the best system which could be used. Probably he should agree with him from one point of view. In a system of this kind, there could scarcely ever be a mishap; but when one district was isolated from the others, there might be an accident at any particular time in that district. But if it were an advantage, at what cost was it purchased? The leakage due to excessive pressure at the highest portion of the district in order to give a few tenths at the lower portion, was a heavy cost to bear for the privilege of having all the mains coupled together. Then there was excessive leakage going on all over the district; whereas an average pressure very much less would be sufficient if district supplies were arranged in accordance with various altitudes. Again, the arterial system was not quite comparable with a system of gas-mains, because if a stoppage took place at any particular artery, the force with which the heart pumped the blood round compelled it to find a course in some other directions, by opening out some of the smaller vessels. But in gas distribution they had a cast-iron inelastic arrangement, which it was impossible to expand so as to make up for any diminution caused by a temporary obstruction in some other part of the system. Mr. Whatmough had referred to the saving in leakage; and Mr. Porter suggested that this saving was probably not so much as he (the writer) had indicated. He did not put the saving forward as an absolute one by any means, but only as an example, for it was impossible to fix an exact figure. The apparatus tended in the direction of economy, inasmuch as the average pressure throughout the whole twenty-four hours was reduced. It was quite impossible to say by how much, or by how little, this leakage might be diminished; but whatever the amount, it was in an economical direction. He had merely put this forward as an example illustrating the tendency of the working of the apparatus. Another gentleman had asked whether the effect would not be the same if the pressure was put on by hand, as if it were put on by the apparatus. It would be precisely the same, if only a man had the knowledge which would enable him to put on by hand the exact pressure required at the exact time to give the full supply at the far end. But no man in a gas-works could interpret the requirements of the district so perfectly as an apparatus which was in exact touch with the consumption going on at the far end, and which would respond with absolute correctness through a variation due to the lighting up or turning out of one burner. The lighting up or lowering of a single burner was sufficient to operate the pressure vessel and control the governor at the gas-works; giving an instantaneous increase or decrease as required. Mr. Child thought an apparatus of this kind would be invaluable in a district such as he referred to, where there were two factories almost at the extreme end; and he (Mr. Chester) quite agreed with him. However intelligently one might endeavour to ascertain the particular requirements of any district on any particular day, by taking pressures at the consumers' houses, one never knew, when one was doing so, that there was not some undue demand at that particular time, or an unusual falling off. Thus the pressure on any particular day might be no guide to what was necessary at some other time; and so the supply as at present worked by hand was always in the condition either of excess or too little pressure to meet the necessities of the case. Apparatus of this kind electrically controlled was always in exact sympathy and touch with the requirements, and would give the consumer the full quantity of gas he required at all times, however varying the quantity might be; and yet it would not allow 1-10th pressure more to be put on the mains than was requisite to give the full pressure in the district determined upon. The instrument was particularly adapted for dealing with such cases as Mr. Sugg mentioned, of heavy clouds coming over a neghbourhood. Anyone who lived in a manufacturing town, and happened to be in the position of being coupled up to the central telephone station, would know that if a sudden cloud came on, and the gas supply was not sufficient in a big factory, there was soon a good deal of disturbance going on. That was exactly what an instrument of this kind prevented. It was in touch with the consumers, and put on the pressure and took it off in accordance with their requirements.

We shall next week complete our report by giving the papers read by Mr. Isaac Carr, on "The Taxation of Gas by Local Authorities," by Mr. Herbert Lees, entitled "Is the Municipalization of Gas Undertakings Advantageous?" and by Mr. T. Canning, on "Gas Distribution in Relation to Modern Municipal Development."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 61.)

After the serious interruption to business produced by the Jubilee festivities, there was a good show of activity evinced at the opening last week, as if to make up for lost time. A pretty firm tendency was the general characteristic; and it was thought that better times were at hand. But these fair promises were not realized; for the activity speedily abated, and the tone became dull. Among disquieting influences, the disagreeable intelligence of disturbances ill-met and ill-dealt with in India, and the recurring apprehension of labour troubles at home, were most prominent. The last settlement of the half year also demanded attention which might otherwise have been devoted to new business. The Money Market enjoyed its usual strength at this season. But as soon as June 30 was over, money could be had on very easy terms; and nothing at present apparent points to a materially increased demand. Gas securities had a busier week than has fallen to their lot for some time. But the greater part of the transactions were in the earlier portion of it; and the last few days relapsed into quietude. The tendency was quite favourable for all classes of undertakings throughout the list; and some considerable advances have been effected in quotations, while, on the other hand, no reduction took place in any one. In Gaslights, the "A" was brisk and buoyant; and the disposition to rise which we noted last week could no longer be denied. The opening price was 317; and though one special low bargain was done at 315 on Tuesday, the closing figure was 318½. In the secured issues, several transactions were marked at steady, but not advanced, prices. South Metropolitan was not active; but it made an upward move after a long period of inaction, and changed hands at 145. Commercials were untouched; and the Suburban and Provincial Companies were almost the same. Brighton ordinary rose smartly; but there were no dealings in it. Among the Continentals, there was a good bit done in Imperial, which continued to grow in favour, and was marked as high as 221; but the other undertakings were little noticed. In the rest of the list, several debenture issues showed an advance on *ex div.* changes. Business in Water was of the usual quiet description; but the tendency was good. Several quotations rose moderately, especially on *ex div.* changes.

The daily operations were: The Gas Market opened lively and strong. Gaslight "A" moved up 1; and Imperial Continental, 2. In Water, Kent and New River advanced 2 each. Business was not quite as active on Tuesday; but prices still rose. Gaslight "A" gained 2 more; and Brighton ordinary, 4. The tendency continued favourable on Wednesday; but quotations were not varied. Things grew much quieter on Thursday; and prices were steady. The only move was a rise of ½ in Hongkong. In Water, Grand Junction was the higher. Friday was a quiet day; and business was mostly in Imperial. South Metropolitan rose 1. Saturday also was no busier than usual. But the tendency was good; and Gaslight "A" improved 2.

ELECTRIC LIGHTING MEMORANDA.

Inauguration of the Shoreditch Scheme of Dust Destruction and Electric Lighting—A Mechanical Romance—Thermal Storage—The Balance of Generation and Consumption—Glorifications.

It is an age since there has been such a beating of the electric big drum as signalized the formal opening on Monday of last week of the combined dust-destroying and electric lighting scheme to which the Shoreditch Vestry stand committed. Our speculative electricians have always been great at opening functions, the magnificence of which on past occasions has not always been justified by the subsequent history of their ventures. Of late years, however, they have perforce been very quiet in this regard; so that one might have been beguiled into thinking that they had grown out of the trick of proclaiming what they intended to do, and were content to let their actual performances speak for them. The Shoreditch incident demonstrates the contrary. Once more our electrical friends have announced their intention of being "just about to begin" to set the Thames on fire—this time by the aid of town's rubbish. We shall see how the event turns out. In the meantime, the nature of the scheme may be explained here briefly; those of our readers who care for fuller particulars being referred to the current issue of the "Electrical Review," which contains an illustrated description of the plant.

The Shoreditch scheme has been in preparation for a considerable time; the Provisional Order dating from five years back. At the outset, the Vestry were very dubious as to the expediency of undertaking electric lighting; but eventually Mr. E. Manville, of the firm of Messrs. Kincaid, Waller, and Manville, was called in to advise the authority; and he evolved a grandiose combination project in which the destruction of town's refuse, thermal storage, electricity supply, the heating of baths and washhouses—and, apparently, the ventilation of sewers and the provision of a public library and museum and technical schools—enter in glorious harmony. This is Progressivism indeed; and accordingly the "Daily Chronicle" has gone into raptures over such a "romance in mechanical science." Romantic it indeed is; and if the ratepayers are able in the future, when the bills come to be paid, to find out what any part of the combination costs, they will be lucky. We will not, however, spoil the romance by attempting to forecast the *dénouement*. The suggestion to utilize—blessed word!—the town's refuse of the parish for the generation of the electricity is really the basis of the scheme. This proposal it was that captured the fancy of Shoreditch, and has aroused the enthusiasm of the newspaper reporters. The ordinary method of disposing of the refuse by sending it away is stated to have cost the Vestry 3s. 2d. per ton. By utilizing it in the manner proposed, they are assured that they will effect an economy of 2s. per ton, and will be enabled thereby to supply electricity at 6d. per unit for the first two hours' consumption, and 4d. per unit afterwards, with a day-consumption rate for power purposes of 2d. a unit. There is, at any rate, nothing revolutionary about these prices.

The utilization of the town's refuse is not to be done for nothing. There is first the cost of the site, which ran up to £35,000. But, of course, as the dust destructors are to afford hospitality to the public library and museum and technical schools, the latter will be expected to bear a handsome part of the expense in consideration of having such eligible neighbours and hosts. The initial difficulty of harmonizing the continuous destruction of rubbish by fire with the intermittent demands on the electricity generating plant, is met, for the first time, by the introduction of Mr. Druitt Halpin's "thermal storage" device. By this arrangement, steam from the boilers attached to the destructors is to be passed during the day into a vessel 35 feet long and 8 feet in diameter, where it mixes with a small quantity of water from the feed-pumps; the proportions of steam and water being so gauged that by nightfall the cylinder will be full of water at the temperature and pressure of that in the boilers themselves—that is, at 200 lbs. per square inch. At lighting-up time, the feed is to be shut off from the cylinder, which is connected to the boilers, which in their turn are connected direct to the engines. Hence the feed into the boilers is that of water at their own temperature; so that the only heat they require when steaming is what is necessary to supply the equivalent of that lost by evaporation at the temperature and pressure. "The result of this arrangement is that the boilers are able to evaporate about one-third more steam"—we quote from the "Electrical Review"—"than they would be able to evaporate were they connected directly with the water-mains, and, moreover, gases can be sent away from the boiler at such a low temperature that they would be useless for the purposes of even an economizer."

There are twelve destructor cells, and six water-tube boilers. The fires are forced by electrically-driven fans, which, according to the "Daily Chronicle," draw the gases out of a neighbouring sewer, "passing them into the furnaces, where they feed the flame." It is a pity that any other fuel is required. The plant is replete with mechanical luxuries. The contents of the dust-bins and street orderly boxes have still to be carted to the site, which cannot fail to be a source of enjoyment to the users of the free library and schools; but once arrived there they are handled by "electric lifts and motor cars," which must rob the material of all its ordinary defects of character. What is to be done on Sundays does not transpire. "It is anticipated that the most efficient rate of working the destructor will be found to lie between 8 and 12 tons per cell per diem." Let us hope that this will prove to be the only thing "found to lie" about the complex scheme. "The combined arrangement of cells and boilers is designed so that when ten cells and five boilers are at work, the average evaporation per hour from refuse only will about equal the average quantity of steam required by the engines throughout the 24 hours." It is thoughtfully observed that, supposing this nice balance is disturbed for any reason, it will still be possible to stoke the boilers with coal. No doubt it will be, and one may hazard the guess that whatever may be the prospects of "thermal storage," the coal pile at this wonderful station will be of about the same size as that of other establishments in the same line of business.

When generated, the electric current is to be popularized in Shoreditch by the enterprise of a couple of Syndicates who are to supply fittings free and current through the agency of penny-in-the-slot meters. The venture had a grand send-off, as already notified. Lord Kelvin was there to bless the Vestry for the energy of the pioneer Vestry of Shoreditch in embarking upon an undertaking "worthy of the Victorian era as an example of the combination of scientific forethought, mechanical skill, and courage." The Chairman of the London County Council was present; as also was the Mayor of disconsolate Swansea, deprived by an arbitrary Parliament of the pleasure of having another grand combination scheme of its own. It was an event the interest of which has scarcely begun.

A Large Irrigation Reservoir.—It is reported that Government surveys are to be made for a reservoir 10 miles long, 2 miles wide, and 150 feet in maximum depth in the heart of the Rocky Mountains, near Laramie (Wyo.), where a rock bottom and complete natural walls have been found, and canals can be cut to conduct the waters of the Big and Little Laramie Rivers and to flood the Laramie and Platte Rivers to supply Western Nebraska and Eastern Wyoming in dry seasons.

JOHN ORWELL PHILLIPS.

THE few lines in the last number of the "JOURNAL," announcing the death of Mr. John Orwell Phillips, at the age of 71, must have been read with feelings of profound regret by many besides those who are concerned in the fortunes of the gigantic undertaking in the building up of which Mr. Phillips earnestly and unostentatiously laboured during the latter half of his life. He was endowed in an uncommon degree with those qualities which are requisite to the making of a successful gas administrator; and only those who have long taken part in the internal operations of The Gaslight and Coke Company can know of the vastness of the work he accomplished and the indomitable energy which he threw into it.

Prior to entering the service of the Company, Mr. Phillips was engaged in the office of a firm of Parliamentary Agents; and the training which he there received was of immense value to him in carrying to a successful issue those projects of amalgamation which have brought the undertaking to its present huge dimensions, and which were (we do not think it will be disputed) in the main the fruit of his fertile brain—his view being that it would be to the advantage of both shareholders and consumers if the small Metropolitan Gas Companies were lifted from the state of chaos in which they then were, and combined in one great whole. At the time of his appointment as Secretary in 1861, there were no less than thirteen Companies supplying gas in the Metropolitan area; while now there are only three. The South Metropolitan Company have taken unto themselves two of the concerns; the Commercial Company have been extended by the addition of the Ratcliff Company; and The Gaslight and Coke Company have absorbed the seven others. Mr. Phillips's predecessor in office was Mr. Charles Burls, whose death was the occasion of the new appointment; and it is recorded that he, like his successor, "rendered long and faithful service to the Company." It was on May 2 of the following year that Mr. Phillips made his first appearance before the shareholders in his new capacity; and so far as we can trace, his distinguished figure has only once or twice since been absent from the half-yearly meetings. Mr. Phillips quickly won favour. It was only at the second meeting after his appointment, that a resolution was passed increasing his salary (which was then £600) by £100 per annum until it reached £1000; and he acknowledged the vote in terms which events have proved were uttered with sincere intention. He said: "I assure you my constant endeavour shall be to merit your confidence, and to promote, to the utmost of my ability, and at all times, the interests and the prosperity of the Company." Comparatively, the concern at that time was a very small one. The accounts in those days were framed somewhat differently to their present form; and it would perhaps be misleading—and indeed useless—to quote many of the figures. To give, however, a general indication of the relative position of the concern at the time Mr. Phillips became its Secretary and when he relinquished his work in 1893, it may be mentioned that the capital in 1862 was, in round numbers, £700,000; while four years ago, it was upwards of £12,000,000. The gas-rental in 1862 was somewhere about £225,000; while in 1893, it was close upon £3,000,000. These figures alone stand as a striking testimony of the expansive power of Mr. Phillips's faculty for administration, and his fitness for the high office he filled.

The few years which intervened between the appointment of Mr. Phillips and the obtaining of the Act of 1868, by which the Company was re-incorporated, were unquestionably for the management the most turbulent ones in the history of the Company; and in the severe fight which the Bill provoked, Mr. Phillips was in the van. In this struggle, his knowledge of parliamentary proceedings was of the greatest utility; and, at all points, he appears to have been well armed. He was able to place his finger upon all weak spots of, and to provide an answer to the allegations contained in, every petition presented against the measure; and his work in this connection has been of lasting benefit to the concern. The Governor in those days was Mr. S. A. Beck. On the first opportunity after the Act had received the Royal Assent, he informed the proprietors, in unstinted language, of the zealous services which had been rendered by Mr. Phillips and the then Engineer (Mr. F. J. Evans); and the proprietors on their part gave substantial evidence of their gratitude to their chief officials. From time to time after this, the union with other Companies took place; and, as a consequence, the work falling upon the shoulders of the Secretary correspondingly increased. In 1885, a change was made in the administrative organization of the Company; and Mr. Phillips was thenceforward known as General Manager of the Company—a position which was undoubtedly his by right, as he had for many years discharged the duties and borne the responsibilities of this office while continuing to be styled Secretary.

As already intimated, Mr. Phillips retired in 1893 from the post which he had so honourably filled; and it was entirely through failing health that he was at length induced to take that step, which he did very reluctantly, in April of the year named, after 32 years' service. In consideration of his valuable labours for the Company, the proprietors, on the recommendation of the Directors, awarded him a retiring pension of 32-40ths, or four-fifths, of his salary, amounting to £2800. The words used by the Governor (Colonel W. T. Makins), in referring to the retirement at the time, were well chosen; and they testify to the esteem in which Mr. Phillips was held by the Board. He said: "It was with real grief he had found it necessary to admit that Mr. Phillips's health was no longer equal to allowing him to continue in a position which he had filled with such conspicuous ability for so long. Mr. Phillips was no ordinary Secretary—no ordinary Manager. He had been, as regarded their Company at any rate, almost the Napoleon or the Wellington of the campaign. The present position of the gas industry in London—at all events, as regarded themselves—was almost entirely due to the initiative of Mr. Phillips, backed up by the Directors; and the amalgamations which had taken place from time to time, and which had been so much in the interests of the consumers and the shareholders of the Company, were all due mainly to the devotion which their friend had given to the interests of the Company." Among the officers of the Company, he was held in equally high regard; and in January the following year, they gave tangible expression to their appreciation by presenting him with a portrait painted by Mr. H. T. Wells, R.A. Although Mr. Phillips had ceased to be a servant of the Company, there was a general desire that, on the first opportunity, his long and special experience should be secured by placing him on the Board; and on the retirement of Sir Hugh Adair in February of the same year, this was done.

Mr. Phillips was also much sought after by those having the control of other gas undertakings; and for some time he was a Director of the Brentford, Malta and Mediterranean, Cagliari, Danish, Lea Bridge, and Ottoman Gas Companies. But the state of his health lately compelled him to resign some of these positions; and we believe his last public appearance in the capacity of a Director was at the meeting of the Brentford Company in February last.

Apart from his business capabilities, it may be said that Mr. Phillips was in every sense of the word a gentleman. He was a man of extremely liberal views, and was deservedly popular—especially among the officers and staff of The Gaslight and Coke Company. In respect to his subordinates, he always acted upon the principle that good work should be followed by good pay. At the time of his resignation in 1893, we expressed the hope that so hard a worker and agreeable a man might live long to enjoy the honourable retirement which he had earned. But it was destined otherwise; for six months afterwards, he had a stroke of paralysis, and complications set in, which ended in his death at his London residence on the 25th ult. The funeral of the deceased gentleman took place last Thursday at Paddington Cemetery, and was attended, in addition to his relatives, by Colonel Makins and other Directors and officers of the Company, and a few business friends.

The following letter which we have received from Colonel Makins, written on the day of the funeral, forms a fitting conclusion to the notice we have here given of the life-work of Mr. Phillips: "I have just returned from the funeral of my esteemed friend and colleague Mr. John Orwell Phillips; and as one who, till his illness a few years ago compelled him to retire from office, was in almost daily communication with him, I should like to place on record my impression of his remarkable and successful career. The secret of his success was his absolute and entire devotion to the interests of the Company of which he was Manager and moving spirit. Day by day he was at the desk in his office at 9 a.m., and gave as his reason that example was the best form of discipline. No one was ever more popular with his subordinates; yet no one was more exacting in requiring strict fulfilment of duty. To his juniors he was always accessible for guidance and advice. In times of crisis and difficulty he maintained the most calm and steadfast bearing, but felt his responsibility most keenly. On many occasions he has come to my house soon after 8 a.m. on his way to the office, to discuss and decide on steps which had to be taken immediately. I urged him nearly a year before he finally retired to take some months' leave of absence. But in vain; and I have no doubt whatever that his stern determination to stick to his post, when he was no longer physically fit for such constant attendance, increased the progress of his malady, and so shortened his life. He was essentially a high-minded man. The one offence he could never be got to condone was anything in the nature of meanness or double dealing. To his great abilities he added unwearied industry, loyalty to his Directors, and urbanity to all who had to approach him on business matters. While we deplore his loss, we can look back with the greatest satisfaction on his career, and on the success of his policy. We can also congratulate ourselves that we have in his successor, Mr. Field, a gentleman who was one of his most trusted adjutants, and whose qualities and abilities are, under differing circumstances, of similar value to our great undertaking."

PARLIAMENT AND THE REGISTRATION OF PLUMBERS.

The House of Commons last week illustrated once more its versatility, after the manner of the proverbial steam-hammer that will forge an anchor or crack a nut at will, by turning from Imperial questions to discuss the Plumbers' Registration Bill. This measure, which has been mentioned on previous occasions in our columns, is a type of the schemes of legislation that arouse the scorn and ire of the Liberty and Property Defence League; and its provisions, if carried into law, would seriously and intimately affect the every-day work of distributing gas and water to the town population of these islands. It is a private member's Bill, which passed its second reading without any intervention on the part of the Government. When the House had affirmed the principle of the Bill, the Government supported a motion referring it to a Standing Committee; and this course has been taken, with the result that the Local Government Board have done what they could within the original framework of the measure to give it a more workmanlike character than it possessed at the outset. It must be confessed that these departmental attentions were badly needed; and it is still very doubtful whether the Bill is worth anything, even from the point of view of those who are prepared to endorse the proposition that some guarantee of the quality of plumbers' work is desirable in the interest of public health.

What the Bill proposes is shortly as follows: It is to create a Council—to be styled the "General Council of Plumbers' Education and Registration"—which is to consist of eight master plumbers or employers of plumbers; eight operative plumbers; and eight town councillors, medical officers of health, or inspectors of nuisances. The foregoing are to represent the English plumbing and sanitary interests; Scotland and Ireland being each represented by two members of the different categories named. The Administrative County of London is to be specially represented on the Council by a contingent of two master plumbers elected by the London Branch of the National Association of Master Plumbers of Great Britain and Ireland; two operative plumbers elected by the United Operative Plumbers' Association of Great Britain and Ireland; two persons elected by the Plumbers' Company; and two elected by the London County Council to represent the Technical Education Board, and the Public Health Committee thereof respectively. In addition to the above, there are the President or other elected member of the master and operative plumbers' societies and twenty others to be chosen from a list of nominees of an innumerable host of qualified bodies. This tremendous machinery, when once put together and set in motion in a specified manner, is to proceed first of all to create branch councils; to draw up a scheme of examination for plumbers who may submit themselves for registration; and to register the passed candidates as duly qualified plumbers. Inasmuch as plumbing is not without its professors and practitioners, the nucleus of the privileged band is to be formed of all plumbers upon the register of the Company; "all such persons who have been engaged wholly or partially in business as plumbers, or employers of plumbers in connection with the businesses of ironmongers, sanitary engineers, or other occupation of the like nature prior to March 1, 1892;" and to these would be added the passed candidates of the Council's examinations.

After all this parade, and more for which we cannot find room, it comes as an anti-climax that the object of the whole scheme is not to secure to registered plumbers the monopoly of the plumbing trade, but only to create a body of registered plumbers, and to prevent anybody else engaged in the trade from styling himself a registered plumber under a penalty of £20. The memorandum on the Bill, as first printed, explains this; and observes that a system of registering plumbers—that of the Plumbers' Company, be it understood—has been established for several years, and that the Bill proposes to place this system upon a broader and more permanent basis. It is quite true that the Plumbers' Company have done something in this way to elevate the standard of plumbing work throughout the country. But so have many municipalities and institutions for improving technical training; and all these interests are up in arms against the present proposal for glorifying the City Company at their expense. This is one obvious source of opposition to the Bill, which, however, does not necessarily engage public sympathy. It does not matter one iota to the public, or to the trades affected by such a Bill as this, whether the Company of Plumbers, or the City and Guilds of London Institute, or any other organization of the kind, is to be singled out for the distinction of being empowered to grant a degree of "R.P." One such corporation may be as good, or bad, as another for all the world cares. The only real question is whether any proposal of the kind ought to pass at all.

The real opposition to the Bill was led in the House of Commons on Wednesday by Mr. Whittaker, who declared that the object of the promoters was not the improvement of the public health, but to secure a monopoly for a trade and powers for a City Company. The masters and workmen in the trade were willing, the honourable member said, to assent to an arrangement of the kind, because examinations and fees would tend to keep men out of the trade. "The plumbing trade has suffered severely in recent years, because of the tendency of large firms to undertake plumbing with gas-fitting, decorating, drains, and the electric light. Plumbers could not embrace other trades; and so other trades were embracing theirs, which was being gradually squeezed out as a separate trade. . . . It was the little men who did the work badly; and these little men wanted to secure these special advantages. Registration would not secure better work. The difficulty in the trade was not want of knowledge, but want of conscience—not want of skill, but want of honesty. No system of registration would provide honesty and conscience; and the Bill would do nothing in securing competent workmen. The employer of a plumber might be a competent man and get registered; but the Bill made no provision that the men he might employ were competent. The whole thing was a delusion, and would do a great deal of harm." These trenchant criticisms went to the heart of the question, and made a marked impression. Mr. Gedge spoke of the defective drafting of the Bill, which he said would only benefit lawyers. Mr. J. Burns opposed the Bill with his customary energy, on the ground that it proposed to put a ring fence round the small master plumber, who is being knocked out by the more scientific large builder and the skilled master plumber who employs good workmen at excellent rates of wages. He did not believe there was any public necessity for the Bill or a particular demand for it, or that, given these conditions, this was the best way to bring the reform about. "A man might pass the highest examination as a plumber, and he might be smothered in certificates; but if economic pressure on the master and commercial incentive in the workman made both conspire to poison a customer with typhoid or sewer gas, no amount of certification or registration would prevent that undesirable end. . . . The Bill would create a class of Corporation plumbers, fortified with certificates and disliking hard work." Mr. Wolff thought the Bill about as defective as any Bill could be. He objected both to the principle and to the details. Mr. John Ellis, as Chairman of the Grand Committee to which the Bill had been referred, expressed his contempt for the Bill, as a crude scheme of legislation which ought never to go upon the Statute Book. Mr. Brigg asked why plumbers should be selected for special treatment in this way. Mr. Pickard, as a Labour member, supported the Bill because the plumbers wanted it, which, from his point of view, settled every question of expediency.

Mr. D. F. Goddard, speaking as one who knew what he was talking about, opposed the Bill on the ground that it afforded no guarantee that the public health would be promoted by it. It set forth that certain people should be registered as qualified and certificated plumbers; but there was no guarantee that certificated plumbers would be generally employed. The Bill did not insist on plumbing being done any more efficiently than now. Much mischief was done by jerry builders, who ran up cheap houses for the poorer classes; and there was nothing to compel them to employ registered plumbers, so that the sanitary arrangements of the houses of the poor might be more satisfactory. Notwithstanding that all the members who were able to speak on the Bill with the authority of personal knowledge of the subject opposed the measure, the House decided to consider it, and proceeded to discuss the clauses until by efflux of time the debate stood adjourned.

Herein appeared one of the curious features of our parliamentary system. The House of Commons professed to be absorbed in the subject of the registration of plumbers; yet there was an unreality about the discussion on Wednesday afternoon that calls for an explanation only disclosed by an incidental remark of Sir J. B. Maple. As a large employer of plumbing labour, the member for the Dulwich Division of Camberwell might be supposed to take a vivid interest in such a Bill as this. He, however, contented himself with denouncing it as an unnecessary and crude attempt at legislation, and then went on to say that he did not object to the House talking about it all that afternoon, because it would thus prevent a still more objectionable measure from being brought in. The honourable member was understood to allude to the Womens' Suffrage Bill, which is on the paper for to-morrow. The laughter with which this frank confession was received, showed that the House of Commons was content to talk about plumbers rather than women voters, because the members thought the former the less objectionable topic of the two. This is doubtless wisdom of a sort; but it is the wisdom of the serpent, which is rarely justified of her children.

There was no particular reason, however, why the House of Commons should not have played with the Plumbers' Bill through an afternoon that might have been more seriously employed, because a few of the more serious-minded of the members had taken care to put down so many notices of amendment that there is not the remotest chance of the measure becoming law this session. Even the sponsor for the Bill had twenty amendments to propose, and Mr. Whittaker, Mr. Bond, and a few other interested gentlemen, were equally solicitous for its improvement. Yet this sort of thing does not exhibit the House of Commons in the best light. The Bill, as a probable majority of the members know full well, is a bad Bill throughout—"lock, stock, and barrel," as the member for Battersea described it, in language as forcible as familiar What the public wants is not the hall-marking of plumbers, but the prevention of bad plumbing; and this is just the end it elaborately misses. The amiable amateurs of sanitary science who

backed the Bill in the interest of public health, committed the fatal mistake of confounding the status of a professional man with that of a tradesman, when they fondly imagined that registering the plumber would be tantamount to securing reliable plumbing and gas-fitting work. Some such guarantee is required in the case of a professional man. But in this instance, it is the professional man himself who does the work for which the public have recourse to him. The licensed priest conducts his services and preaches; the soldier or sailor fights and organizes; the barrister advises and pleads; the engineer counsels and executes. Not so the tradesman. Sir J. B. Maple, for example, is the head of a firm that employs many plumbers, good men and true in their degree; but it is not necessary that the head himself should be able to "wipe a joint." The public send to a firm to get their work done, because it is known to be a substantial house, such as can be depended upon to do good work and to guarantee it for the sake of their own credit. No system of registration can touch this aspect of the business. The chief sufferers from defective or dishonest plumbing are the poor, and the large class of those who are perforce exposed to the wiles of the speculative builder. Them the local authority can, and should, protect—not by any fallacious licensing of a tradesman who, after procuring his certificate, need never touch a piece of piping, but by a sufficient and honestly carried out system of regulation and inspection. There is no valid reason why every piece of plumbing or gas-fitting, involving risk to health or life in the case of bad work, should not be compelled to satisfy a fixed and known standard of materials and workmanship. Let this be done under the public-spirited administration of a municipal committee; and any body that likes may examine and issue certificates to the plumbing fraternity. Where it is not done, certificates will be in vain. Many English municipalities have tried the obvious device of licensing plumbers and gas-fitters; but the idea of protecting the public by this means has proved illusory. There are no means of preventing the licensed plumber—who is as often as not a jobbing builder—from subletting his jobs to unlicensed contractors; and in this way, it often happens that the only tangible effect of the licensing arrangement is to make the householder pay two "masters" instead of one. This project of registering plumbers is precisely one of those pseudo-sanitary measures that can be relied upon to catch the votes of retired medical men and the general body of *dilletante* sanitarians, who have done so much to bring hygienic legislation into ridicule. But it is rank folly, and nothing else.

MR. F. EGNER ON INCLINED RETORTS IN EUROPE.

In the "Journal" for the 15th ult., we gave the paper read by Mr. F. Egner, of Norfolk (Va.), at the recent meeting of the Western Gas Association, on the subject of his visit to Europe to investigate the working of inclined retorts. For reasons then stated, he was unable, owing to want of time, to lay before the members as full details as he could have wished; but these he has since furnished in an article which appears in the current number of the "American Gaslight Journal." From this we make a few extracts, by way of supplement to the paper above referred to.

Mr. Egner proceeded first to Salford; visiting this place on April 3, 4, and 5, and again on May 4. His impressions as to the working of the system having been shown in his paper, only those items not then given will be quoted now. According to the statement of the Engineer and Manager of the works, in sloping retorts 18 feet long, ⌂ shape, and 22 in. by 16 in. in section, 672 lbs. of coal were carbonized in six-hour charges, The same weight of coal had been carbonized in four-hour charges; but, for reasons of no special interest to the reader, six-hour charges were at that time preferred. The coal was described as, and seen to be, of poor quality. The make of gas per retort per 24 hours was 12,230 cubic feet; but 18,345 cubic feet had been made. The retorts were set seven and eight in a bench—sevens being preferred; 69,813 to 76,100 cubic feet per man engaged in the retort-house was the work done; and then the men were not more than half employed. They could have attended to more retorts had they been required to do so. Huddersfield was visited on the 6th of April, and the following figures were obtained: The gas made per retort per day was 15,624 cubic feet; retorts 20 feet long, 24 in. by 13 in. in section, and set nine in a bench. The men worked eight-hour shifts, and per man employed per shift 83,228 cubic feet of gas were made. By "man employed" is meant the men working in the retort-house exclusively.

At Brentford, which was twice visited—on April 8 and 30—Mr. Egner says he found Mr. Husband most obliging. The retorts seen were 20 feet long and 24½ in. by 14 in. in section, ⌂ shape, and set six in a bench. There were also some sevens; but the sixes were preferred. Formerly 728 lbs. of coal were charged per retort every six hours; but on Mr. Egner's most recent visit he understood that 4 tons of coal were charged per bench and shift of eight hours. He explains that by this it is not to be understood that eight-hour charges are indulged in; but rather that the men work in eight-hour shifts, and have 4 tons of coal to dispose of for each bench, or the number of retorts equal to one bench, in that time. The make per retort ranged from 13,500 to 20,160 cubic feet in 24 hours. The best make per man, per shift of eight hours, was upwards of 80,600 cubic feet. At that time, to deal with 96 retorts the following hands were employed: One man on the charging-floor, four men on the discharging-floor, one fireman, one pipe-jumper to clear stopped pipes, and one boy to help the fireman and wheel out such coke as was not removed by the waggons, that were hauling it out constantly for sale in the town. Seven men and one boy, each working eight hours, were making gas at the rate of 1,935,360 cubic feet in 24 hours.

The daylight hours of April 10, 11, and 12 were spent at Rheims, partly in the company of M. Coze. Mr. Egner mentions "daylight hours" because he did not waste time by sleeping at hotels when he could gain it by travelling, and resting as best he could. The retorts were found to be about 10 ft. 6 in. long, and 23 in. by 14 in. in section, ⌂ shape; and 374 lbs. of coal constituted the charge every four hours. The make per retort per day was 10,210 cubic feet; and as the benches were nines, the production per bench was 91,890 cubic feet. The make per man could not be given, because the few men who attended to the drawing and charging of the only two benches used on the Coze system were employed at other work most of the time, and not exclusively at the benches.

Cassel was the next place visited. There were 158,423,298 cubic feet of gas sold during the year 1896; and as they have no water-gas apparatus or other retorts at the works, all was made in slopers. The retorts are set in benches of nine; and the make per bench, including all stoppages or time lost for the year, averages 85,114·21 cubic feet per 24 hours. The coal yields 4·65 cubic feet of gas per pound. The retorts are about 11 ft. 6 in. long. The make per man employed is given as 46,795 cubic feet per day. These figures were obtained from the annual report by the City Engineer, Herr Emil Merz.*

From the 14th to the 18th of April, Mr. Egner was engaged in the inspection of the gas-works in Berlin, the respective Managers of which were interviewed concerning the subject under investigation. At the works of the Imperial Continental Gas Association, no slopers were in operation; but 26 benches of nine retorts were in course of erection. At the Municipal Gas Works, the following results were reported: The yield of gas per pound of coal used was only 4·41 cubic feet; but the production in both horizontal and sloping retorts was the same per pound of coal carbonized. The sloping retorts were only about 9 ft. 7 in. long and 22 in. by 13 in. in diameter, elliptical in shape, nine in a bench; and the charges were 418 lbs. every four hours. Per man employed doing all the work, except bringing coal (removing the coke, however), per shift, 49,771 cubic feet of gas were made. The men worked 12-hour shifts; but Mr. Egner says they were apparently taking things pretty easy. The make per retort in 24 hours was 11,060 cubic feet. With the horizontal retorts, heated by similar furnaces, using the same kind of coal, it was 8732 cubic feet, and per man per shift 33,992 cubic feet. He remarks on these results: "This was the poorest relative showing as to horizontal and inclined retorts that I found on my whole trip, which may be partly accounted for by the fact that the works were municipally-owned works, and that the Engineer and other officers (who, without flattery, I can say seemed fully up-to-date in their profession—in a word, very able men) had to accommodate themselves somewhat to the existing conditions, and simply do the best one could expect under the same."

From Berlin, Mr. Egner moved on to Dresden, where the 19th and 20th of April were devoted to an inspection of the gas-works. This city, the official home of Herr Baurath Hasse, also owns the gas-making plant. The retorts and benches being similar to those at Vienna, it was found that, with coal yielding 4·4 cubic feet to the pound, 11,906 cubic feet were made per 12-feet retort, set nine in a bench, in 24 hours. As stated, these benches were similar to the earlier installations at Vienna; and these having now been much improved, Mr. Egner proceeds to a consideration of them.

The 21st and 22nd of April were spent in Vienna. All the gas-works were visited; and the plans of the new municipal plant were seen and explained under the direction of the Chief Engineer of the City, Herr Hermann. The following comparative statement of results with sloping and horizontal retorts, though compiled at the Vienna office, was given to Mr. Egner by Mr. R. W. Wilson, the Secretary of the Imperial Continental Gas Association. It was part of a report to be read at the then forthcoming meeting of the German Association of Gas and Water Engineers, at Leipzig, and was submitted to the principal office for approval. Mr. Egner was permitted to use the particulars. The first figures relate to ten Coze benches of nine retorts, each about 15 ft. 9 in. long. The make of gas per retort per day is 17,638 cubic feet; the total make of the 90 retorts, being 1,589,269 cubic feet. The men work 12-hour shifts; and five men—two on the top and three below—constitute a shift, with one additional man in each 24 hours for the furnaces, which are clinkered once in 48 hours. The make per man per working day (12 hours) is 144,479 cubic feet. The coke falls from the retorts directly into the yard, and is thence taken away for sale. The second set of figures refer to 24 Hasse-Didier generator

* Some additional particulars will be found in an article which appeared in the "Journal" last week.

benches of nine retorts, each about 9 ft. 2 in. long, using Foulis machines. The make per retort per day is 8,122·93 cubic feet; the make by the 216 retorts in 24 hours, 1,754,553 cubic feet; the men required per shift, four machinemen, five helpers, five men to remove coke out of the way of machines, and one fireman—total, 15 men per shift, and 30 men in 24 hours. The make per man per day is 58,485 cubic feet of gas. The third group of figures also relate to 24 Hasse-Didier generator benches of nine through retorts, about 11 ft. 2 in. long, with Foulis machines. The number of men employed per shift of twelve hours is two machinemen, eight helpers, and one fireman, or eleven men per shift. The make of gas per retort per day is 9182 cubic feet; the total make in the 24 hours being 1,983,408 cubic feet, and the make per man per shift 90,155 cubic feet. The last group of figures are in reference to 24 Hasse-Didier generator benches of nine retorts, about 9 ft. 2 in. long; manual labour being used. The number of men employed in this case is 24 stokers and one fireman per shift of twelve hours—a total of 50 men per diem. The make of gas per retort per day is 8476 cubic feet; or, altogether, 1,830,838 cubic feet. The make per man per shift is 36,317 cubic feet. Calculating the expense of each installation, with wear and charges, and 6 per cent. for interest on the capital investment, Mr. Egner says the relative cost per 1000 cubic feet of gas made will come out in the following proportions, taking the manual labour section as 100: Inclined retorts, 39·94; Foulis machine stoking, No. 1, 90·01; do., No. 2, 62·31. And he adds that "the Foulis apparatus is a very good one indeed for the purpose used." He concludes with the observation that every experienced gas maker knows that results do not depend upon similarity of apparatus, and that greatly varying yields may be produced by different managers from the same apparatus. This will, in part, explain the different results.

Mr. Egner, while in London on his way back to America, received an invitation to attend the meeting of the Incorporated Institution of Gas Engineers. In the course of his conversation with various representative gas engineers on that occasion, he says he found the opinion was, without a single exception, favourable to the good impressions gathered by him concerning inclined retorts. He says: "That they will last as long as, and possibly longer than, horizontal retorts was conclusively seen; that they cost less per 1000 cubic feet of gas produced than any form of horizontal retort, with or without stoking machinery, was asserted and shown in their books by those who had had some years' experience with both kinds; and that they must result in economy in manipulation, anyone's common sense can scarcely fail to point out." Having spent much time and money on this subject, Mr. Egner trusts he may be excused from further explanations, and leave the gas profession at large to take up this improvement, or leave it alone, as their good sense or fancied interests may dictate.

Acetylene Regulations in Switzerland.—The Swiss Intercantonal Congress for regulating the production and use of acetylene has drawn up the following prescriptions, subject to final revision: Government permission is necessary for erecting and employing plant for making acetylene. The use of liquid acetylene and portable lamps for it is forbidden. Calcium carbide should be stored in separate places, dry and easy to ventilate, into which no light must be taken. Supplies of carbide must not exceed 50 kilos. (1 cwt.). The pressure in the producing chambers, pipes, and receivers must not exceed 6 centimetres (2·4 inches); and the apparatus must be fitted with pressure-gauges, working automatically, for facilitating a check on the pressure. The use of pure copper is forbidden for lighting appliances. The conduct and supervision of the plant is only to be entrusted to persons who can be depended upon, and who are conversant with the properties of the gas and the use of the appliances. Each appliance is to bear a prominent notice that unauthorized persons are forbidden to touch it. Penalties are to be imposed for any contravention of the prescriptions.

Will Free Wiring Pay?—In our "Electric Lighting Memoranda" to-day, reference is made to the arrangement come to by the Shoreditch Vestry with two Syndicates who will undertake the free supply of electric light fittings—one to consumers who are ready to pay 6d. a unit on the penny-in-the-slot principle; the other to those who will pay the Vestry ¾d. extra for every unit of electricity consumed. Our contemporary "The Builder" fails to see how these Syndicates expect to pay their way. "Supposing that the fixing of each lamp costs on an average £1, and that it consumes 20 units per annum (an outside limit), then the income on this lamp will be 1s. 3d., or 6¼ per cent. on the initial outlay, which is far too small for such a precarious business. Supposing that they fit a shop with 30 lights, and that the shopkeeper, finding his electric bills excessive, prefers to use gas, how are they to get their interest? It seems to us also a wretchedly unjust system whereby the small and constant users are fined for the benefit of those who like a great illumination on special occasions. The class for whom the Vestry ought to cater are discouraged, and unprofitable users are attracted. Surely a far more equitable arrangement would be to charge so much per lamp installed, and not per unit consumed. Consumers had better have independent tests made of the quality of the work put in, and then use the light sparingly, as they will find that it will cost as much as gas at 5s. per 1000 cubic feet, and not 2s. 10d. as stated by Lord Kelvin."

OBITUARY.

The death is announced of Mr. J. W. Longbottom, who has occupied several public positions in Halifax. Among them was that of Chairman of the Corporation Water-Works Committee; and during the years he held this office, he was instrumental in introducing important improvements.

The death occurred on Monday last week, at his residence in Southsea, of Mr. W. Edmonds, J.P., the senior partner in the firm of Messrs. Edmonds, Son, and Clover, chartered accountants, of Portsmouth. Deceased was a Director of the Portsmouth Water Company and of the Woking Water and Gas Company. He was an active member of the Council of the Institute of Chartered Accountants, and a fellow of the Statistical Society. He had been in failing health for about twelve months.

PERSONAL.

The Council of the Society of Arts have awarded a silver medal to Dr. Percy F. Frankland, F.R.S., for his paper on "London Water Supply," of which an abstract appeared in the "Journal" for the 22nd ult.

Mr. A. E. Walker, lately in the Engineer's Department of the Southwark and Vauxhall Water Company, has become Deputy-Manager and Assistant-Secretary, under Mr. J. R. Downes, at the East Surrey Water-Works at Redhill.

Mr. Harold Woodall, second son of Mr. Corbet Woodall, M.Inst.C.E., and Assistant Electrical Engineer to the Hampstead Vestry, has been appointed Assistant to Mr. G. F. L. Foulger, Distributing Engineer to The Gaslight and Coke Company.

Mr. W. M. Gale, who has been filling the position of Resident Engineer on the Loch Katrine tunnel and outlet works of the Glasgow Corporation, has been appointed Assistant Water Engineer, with an addition of £100 per annum to his salary.

Mr. Peter Watson, who is retiring from the post of Manager of the Stirling Gas Company's works, after many years of service, was last Wednesday presented, by the employees of the Company, with an easy-chair, as a token of their esteem and regard for him.

Mr. J. Foster, of Nelson, has been appointed, out of fifty candidates, Engineer and Manager of the Leigh (Lancs.) Gas-Works, in succession to Mr. A. T. Fletcher. Mr. Foster was assistant to his father at Nelson, and also filled the position of Engineer of the electric lighting works of the Corporation.

The Directors of the Compania de Gas de Valparaiso have appointed Mr. Dunn, M.Inst.Mech.E., of Selby, to inspect and superintend the construction of a telescopic gasholder 80 ft. in diameter and 24 ft. deep, now on order from Messrs. Ashmore, Benson, Pease, and Co., of Stockton-on-Tees, for erection at their works at Valparaiso, Chili. The holder is to be a rope-guided one on Pease's patent principle.

The Gas and Water Committee of the Oldham Corporation have passed a resolution, transferring the supervision of the gas and water undertakings to Mr. Arthur Andrew, who for nearly twenty years was assistant to his brother (the late Mr. Herbert Andrew) while he held the office of Chief Superintendent of both departments. At the same time, the Committee propose to make an addition of £50 per annum to Mr. Andrew's salary.

The Albert Medal of the Society of Arts for the present year has been awarded, with the approval of H.R.H. the Prince of Wales, President of the Society, to Mr. G. J. Symons, F.R.S., "for the services he has rendered to the United Kingdom by affording to engineers engaged in the water supply and the sewage of towns a trustworthy basis for their work, by establishing and carrying on, during nearly forty years, systematic observations (now at over 3000 stations) of the rainfall of the British Isles; and by recording, tabulating, and graphically indicating the results of these observations in the annual volumes published by himself."

Mr. J. D. Smith, of Selkirk, has been appointed Manager of the Stirling Gas Company's works in place of Mr. Peter Watson, resigned. Mr. Smith is 29 years of age, and is the son of Mr. J. Smith, of Hawick, with whom he learned the business of gas making. In addition, he served an apprenticeship to the mechanical engineering trade. He holds first-class certificates for machine construction, building construction, and chemistry. He became Manager of the Selkirk Gas Company's works four years ago, and since then he has considerably improved them, particularly by the introduction of a system of regenerative firing, which has proved a thorough success. He is Secretary of the Waverley Association of Gas Managers, which post, it may be expected, he will now vacate.

The Chemical Composition and Strength of Steel.—In a paper just presented at the convention of the American Society of Civil Engineers, Mr. A. C. Cunningham suggests the following relation between the strength of steel and its chemical composition: "To find the approximate tensile strength of structural steel, to a base of 40,000 lbs., add 1000 lbs. for every 0·01 per cent. of carbon, and 1000 lbs. for every 0·01 per cent. of phosphorus, neglecting in normal steels all the other constituents present."

TECHNICAL RECORD.

THE IMPROVED DENAYROUZE BURNER.

One of the most interesting of the incidents of the recent meeting of the Société Technique du Gaz en France was the introduction to the notice of the members, by M. Denayrouze, of his new high-power incandescent burner, to which, it may be remembered, Professor Lewes referred in the course of his lecture at the meeting of The Gas Institute at Bath. On the occasion of the gathering of the French Society at Clermont-Ferrand last year, the entrance to the Casino de Royat was illuminated by a number of tolerably powerful Denayrouze lights obtained by means of appliances on which the opinions of the assembled gas managers were invited and carefully noted. The result sought was then obtained by means of a small ventilating fan driven by a very minute electric motor. Upon the high quality of the light and the economy of the combustible necessary to obtain it, there was unanimity of opinion; but it was thought that the complications and accessory expenses attending the system, owing to the use of electricity, were of such a nature as to greatly restrict its application. Apart from this, however, it was acknowledged that the light produced in the way shown placed in the hands of the representatives of the gas industry a good weapon with which to fight the electric arc light. M. Denayrouze at once set about meeting the objections raised to his burner; and he very soon produced a new arrangement in which the use of electricity was not required. This he patented; and it was described in the "JOURNAL" a few weeks ago. There, it may be remembered, the mixing-fan was actuated by a jack wheel set in motion by the upward current of the combustion products. Of course, this was an important advance. When, however, the inventor came to calculate the extent of the purely mechanical effort necessary for the production of the mixture of air and gas, and its conveyance, under the requisite conditions, to the incandescent mantle, he found that he could secure this result not only without electricity, but without any mechanical appliance whatsoever. He carefully investigated the behaviour of the molecules of gas and air in a bunsen burner; and he had no trouble in discovering that, by making a very simple addition to his burner, he would be able to produce, in connection with incandescent gas lighting, an analogous effect to that realized in the case of motive power by the attachment of the expansion cylinder to the previously well-known mechanism of a steam-engine. The result of his labours he stated succinctly to the members of the French Society as follows: The mixture formed in the burner, without electricity and without mechanism, possesses identically the same characteristics as that produced by the previous more complicated systems. The auxiliary appliances are dispensed with; but air and gas, in suitable proportions, are brought into combination, and acquire just as much motive force as when they were propelled by the fan. The new burner differs from the original incandescent burners by the interposition between the mantle and the bunsen burner which forms the lower part of all appliances of this character of a special expansion chamber, the effect of which is to give to the light emitted by the mantle a peculiar colour and brilliancy.

The new burners were submitted to a long series of practical trials before they were offered as commercial articles. It was in October last that some of them were first fitted up in Paris. But for three months the Denayrouze Company would only let them on hire, so as to retain the right of supervision and maintenance. The trial proved them to be possessed of enduring qualities, and to be easily manageable by ordinary workpeople, hotel waiters, domestic servants, and others. As soon as the results of the trial were known, the burners were put on the market. They are obtainable singly, or, as shown at the recent meeting of The Gas Institute, in groups. The No. 2 burner, with a mantle specially constructed by the Auer Company, consumes about 9½ cubic feet of gas, and gives the light of 160 to 190 candles; No. 1 (a smaller burner) uses 5 cubic feet per hour, with a corresponding yield of light. It has been found in practice that the duration of the mantles is three or four times greater with the new burners than with the old ones; the vibration due to the movement of the interior mechanism having been inimical to the preservation of their solidity. Contrary to a generally held opinion, the temperature of the flame does not cause increased wear and tear of the mantle; while the absence of a chimney removes an element of outlay which attends other systems. For provincial use, a special burner suitable for places where the pressure of gas is low has been made. If only a small, but at the same time satisfactory, light is needed, the glass chimney may be dispensed with; but for lights of higher power one should be employed. For still more brilliant lighting, one of the numerous combinations, one of which was shown in the "JOURNAL" for the 22nd ult., may be adopted. As our readers will recollect, the burner was exhibited early in the year at the Royal Aquarium; and we now learn that an opportunity is being afforded for witnessing its performance in the public streets. The Denayrouze Light Syndicate have placed a five-light cluster on the refuge at the corner of Wellington Street, Strand, opposite the Lyceum Theatre; and they are about to fix in that street and Bow Street 25 single burners reaching to Waterloo Bridge.

SHALE DISTILLATION AND THE PRODUCTION OF SULPHATE OF AMMONIA.

At the close of the notice of the reports of the District Inspectors under the Alkali, &c., Works Regulation Acts, 1881 and 1892, which appeared in the "JOURNAL" for the 15th ult., reference was made to some particulars as to the progress of the shale-distillation industry included in the report made by the Chief Inspector (Mr. R. Forbes Carpenter) to the Secretary for Scotland. It was pointed out that it was the wider adoption of the "Pentland" retort of Messrs. Young and Beilby in 1884, coming as it did concurrently with the high prices then prevailing for sulphate of ammonia and the introduction of new processes for refining crude oil and the production of solid paraffin, that gave a considerable impetus to the industry. In 1883, only 19 per cent. of the shale mined in the United Kingdom was distilled in retorts based on this principle; whereas in 1894, the quantity was 92 per cent. Mr. Carpenter had received from Mr. Beilby a communication in which he gave the figures reproduced below:—

Year.	Total Shale Mined in the United Kingdom. Tons.	Total Sulphate of Ammonia Recovered from the Shale. Tons.	Yield per Ton of Shale Mined. Pounds.
1882	1,030,960	5,900	12
1883	1 167,900	6,400	12
1884	1,518,800	9,500	14
1885	1,770,400	16,200	20
1886	1,723,500	18,000	23
1 87	1,411,000	21,100	—
1888	2 076,400	22,100	24
1889	2,014 000	24,000	26
1890	2,212,200	24,700	25
1891	2 361,100	20,600	25
1892	2,089,900	23,100	25
1893	1 956,500	28,500	31
1894	1,986 300	33,000	37
1895	2,212,000	38,300	39

Mr. Carpenter notices a discrepancy in the figures for 1887, as some returns obtained from another source give the output for that year as 1,390,320 tons, and the quantity distilled in thirteen works as 1,869.300 tons. A certain amount of shale is used in some gas-works, in place of cannel, for raising the illuminating power of gas; and for these and other uses Mr. Beilby has not made any deductions in his table. Referring to his figures, Mr. Beilby remarked that it might be held broadly that the increased yield per ton correctly indicates the gain realized by the use of the new system; but that there are two other possible sources of gain which might be held to account for a part of it. These are improved recovery of ammonia by better scrubbing of the gases, and certain alterations in the quality of the shale distilled. "As to the first of these," said Mr. Beilby, "for the first five or six years of the new system the actual recovery from the gases was less excellent than it had been before, because the works were suddenly called upon to deal with five or six times as much gas per ton of shale as they had to deal with under the older system; and much disappointment was experienced with most of the earlier installations of the new retorts, because they had been insufficiently provided with condensing and scrubbing plant. Therefore, as accounting for the increasing yield of sulphate per ton from 1883, this may be dismissed. As to the second source of possible gain, there is no doubt that alteration in the quality of the shales distilled has had an important influence. The deeper or Pumpherston shales were only worked after 1882, because prior to that year it would not have paid to work them in any of the existing retorts. The special feature of these shales are: Small yield of oil, small amount of fixed carbon, high (relatively) percentage of nitrogen, and the infusibility of the mineral ash. The last three features are specially favourable to working under the new system. Under the older system, they yielded 19 or 20 gallons of oil, and from 20 to 25 lbs. of sulphate of ammonia; under the new system, the yield of sulphate rose from 60 to 70 lbs. per ton, and the paraffin yield was also improved. The figures of the statement show that the direct effect of the new system has been to nearly treble the yield of sulphate per ton of shale; while the indirect effect has been to bring into use shale which could not otherwise have been profitably worked, hence increasing the general output."

Mr. Carpenter remarks that it is held by competent judges that, in view of the severe stress of competition to which the Scotch oil trade has now for many years been subjected from the American and Russian supplies, only the two above mentioned advantages that have been thrown into the scale have turned it in favour of a continuance of the Scotch oil industry. The relief appears to have come, in a most momentous crisis, just at the right time.

In the "Pentland" retort, the shale is continuously distilled, and its fixed carbon finally gasified, in one and the same vessel. The use of steam for gasifying purposes in the lower, and for sweeping away the paraffins distilled in the upper portion of the retort, is accompanied by an increased yield of ammonia, which incidental advantage was at the time much greater than it is at present, owing to the then higher market price of sulphate of ammonia. For gasifying purposes, a certain limited proportion of air is needed; and its access is easily provided for in the lower door of the retort. This has the effect, moreover, of promoting

oxidation of the sulphuretted hydrogen returned to the retort with the steam from the "cracker boxes;" the product possibly entering partly into combination with the ammonia evolved in the upper and middle portions, which now has less sulphide and more sulphur in the oxidized condition than in the earlier forms of retort. Almost every kind in use to-day, moreover, is based on this fundamental principle, which has led to further incidental advantages in completely altering the character of the "bings" of spent shale which are so noticeable a feature of the landscape in the shale districts. Not unfrequently, and not unjustly, complaint was directed against the nuisance proceeding from the smouldering mineral matter incompletely burned out and put on the bing. With the modern system, this never occurs.

The retorts now used in shale distillation are of greater height than the first "Pentland" retort, and various modifications have been made from time to time in detail; an improved form having been introduced during the year, for which the claim is made that no additional fuel for distillation is required beyond the gases derived from the retort itself. Practice, however, is so varied in the several works, and the composition of the shale used differs to such an extent, that the Pumpherston retort, where an increase in the diameter of the retort is made (the retort itself being of circular section) must still be said to be on its trial with the other varieties, each claiming superiority on certain points.

Iron and Steel Institute.—At the forthcoming meeting of this Institute at Cardiff, Mr. D. A. Louis, F.I.C., will contribute a paper on "The Iron Industry of Hungary;" and Mr. T. Wrightson, M.Inst.C.E., will read one on "The Application of Travelling Belts to the Shipment of Coal."

Carbide of Calcium as an Insecticide.—The subject of the employment of calcium carbide as an insecticide, referred to in the "JOURNAL" for the 15th ult., has been brought before the Academy of Sciences by M. Chuard, who alluded to its use for the destruction of *phylloxera*. After the acetylene has been generated by the action of water upon the carbide, ammonia continues to be slowly given off. By preparing a carbide rich in phosphide, a phospho-carbide is produced which, it is claimed, possesses exceptionally powerful insecticidal properties.

Society of Chemical Industry.—The annual general meeting of this Society will be held in Manchester, from the 14th to the 17th inst.; and judging from the programme of proceedings issued by the Secretary of the Manchester Section of the Society (Mr. J. Carter Bell), it promises to be highly interesting to the members. The general business will be transacted in the Chemical Theatre of Owens College, where the President (Dr. E. Schunck, F.R.S.) will deliver his Inaugural Address. In connection with the meeting, there will be invitations to garden parties by the President and Mr. Frankenburg, a member of the Corporation, and to a reception by the Lord Mayor. Various visits have been arranged; among the places set down for the afternoon of the first day being the gas-works, the hydraulic power supply station, and the electric lighting plant. The annual dinner will take place on the evening of the second day, after a reception by the President.

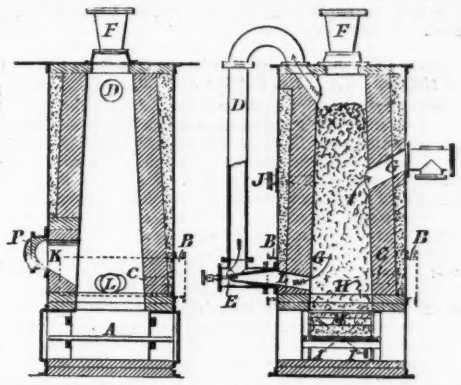
A Close Estimate of the Yield of a Watershed.—In his annual report for 1896, Mr. W. H. Baldwin, Engineer of the Water Board of Yonkers (N.Y.), calls attention to the accuracy of the estimates of the quantity of water available in the watershed from which the city obtains its supply, as made by Mr. W. W. Wilson in 1874. In preparing his plans preliminary to the construction of the storage reservoir in the Grassy Sprain Valley, Mr. Wilson estimated that 14 inches of rainfall a year could be utilized, and that 1179 million gallons of water could be relied upon in a dry year, provided there was no waste. Comparing this estimate with the data furnished by consumption records of the last few years, Mr. Baldwin says Mr. Wilson's report reads more like history than prophecy. In 1892, the consumption was 784 million gallons; in 1893, 838 millions; in 1894, 990 millions; in 1895, 1099 millions; and in 1896, 1213 millions. Up to 1895, the supply exceeded the consumption; but that was a dry year, and the service fell short in the fall.

Completion of the New Reservoirs of the East London Water Company.—Last week the water was turned on from the new reservoirs of the East London Water Company for the supply of the district. These reservoirs, which have been constructed at Walthamstow under the powers obtained by the Act of 1894, bring the total storage of the Company up to 1200 million gallons. They are three in number. One is an enlargement of the old Race-course reservoir, and was in use last year; the other two—called the Warwick reservoirs—are entirely new. The three are connected by a tunnel, in which a large upright shaft has been constructed; and from this a 48-inch pipe passes underneath the meter-house into the private river by which the water is conducted to the filter-beds at Lea Bridge. The outlet works are built of masonry, and there is a weir about 20 feet wide, over which the water passes into the channel below. Inside the meter-house is a Venturi meter, capable of registering up to 60 million gallons a day. By the completion of these works, the storage of the Company has been doubled since the summer of 1895.

REGISTER OF PATENTS.

Producer and Water Gas.—Whitfield, C., of Kettering. No. 12,771; June 10, 1896.

This process for manufacturing producer and water gas consists in raising the fuel to a high temperature at or near the bottom of the generator or producer, by forcing in air, and injecting into the incandescent fuel (at a point above the zone of combustion) steam and the volatile compounds given off from the "green fuel" at the upper part of the generator, and in then leading away from it the products of combustion of the fuel and the products of the decomposition of the steam and volatile compounds, before they reach the upper part where the volatile compounds are given off from the green fuel.



The apparatus in question is shown in the engraving—in vertical sections, at right angles to each other. The arrangement is such that, at a foot or two above the grate or bottom A of the generator, is formed a belt B, extending more or less around it, with openings C leading to the interior of the fuel-space just above the zone of combustion. The belt is connected by a pipe or conduit D with the top of the generator, where the fuel is admitted. In the pipe is placed a steam-jet E, in such a manner that the flow of steam induces a current from the upper part of the generator to the belt, so that the steam to be decomposed carries with it the volatile compounds evaporated from the fuel at the upper part of the generator, and which is introduced through the hopper F. The action of the steam-jet produces a circulation of steam, of products of combustion, and of vapours from the fuel in the upper part of the generator, in such manner as to render it almost impossible for any of the heavier vaporized hydrocarbon compounds to escape to the outlet G (which is placed 2 or 3 feet from the top of the generator) without first passing through a mass of incandescent fuel at H, and there becoming decomposed or otherwise fixed.

I is an opening for the admission of air into the closed ash-pit below the fire-bars, from the blowing engine or fan; J is a sight-hole for viewing the interior of the producer when at work; and K is an opening through which the generator can be cleaned out when necessary. This opening is kept normally closed by a lid P.

Assuming that the fuel at the lower part of the generator at M is in a state of combustion, and at the part H in a state of incandescence, and that the green fuel at the upper part is comparatively cool, but kept hot enough (by transmission of heat from the incandescent fuel below) to give off volatile hydrocarbon compounds, these latter are drawn away through the pipe D by the steam-jet, and are delivered along with the steam into the incandescent fuel H—just above the zone of combustion. The volatile hydrocarbon compounds and the steam are decomposed by the incandescent fuel, and pass off, along with the carbonic oxide produced by the combustion of the fuel at the lower part of the furnace, through the outlet G.

When liquid fuel is employed as well as solid, it may be injected as liquid along with the steam, or be vaporized first at the top of the generator, or by utilizing the sensible heat of the gas after it leaves the generator.

Generating, Storing, and Cooling Acetylene Gas.—Thorn, F. S., and Hoddle, C., of Camberwell, S.E. No. 15,962; July 18, 1896.

According to this invention, there are provided, in connection with a gasholder, one or more calcium carbide containers, in the form of trays, which slide and can be hermetically closed in cylindrical or other holders. They are divided by partitions transversely into a number of adjacent compartments, in such a manner that, when water has filled the first compartment, it flows over into the second; and, in order that the water may be evenly distributed and fill the second and following compartments, there are gauze or perforated funnels or tubes into which the water flows from one compartment to the next. The sliding cylinder of the holder is connected by a chain to a ball-cock or other valve, fitted to a pipe inside and near the top of the holder, and in communication with the carbide container; and a second pipe, with stopcock attached, passes through from the outside of the container into the bottom of the holder. A gas-pipe, which acts as a condenser, passes down from the inside of the top of the holder through the water contained in it into a cooling chamber—preferably secured to the bottom of the apparatus, and provided with an outlet-pipe for the gas and an outlet-cock for draining off the condensed water.

Manufacture of Heating Gas.—Wise, W. L.; a communication from E. Thomson, of Swampscott, Mass. No. 16,692; July 28, 1896.

The object of this invention is to provide gas (similar in some respects to water gas) for use in engines, or for general heating purposes. The invention is based on the same principles as have been employed in the production of a fuel gas—namely, the passage of steam over very hot carbonaceous fuel. In the invention, also, the combustion is kept up simultaneously by the passage of air over a portion of the combustible.

The chief advantage said to be secured by the invention is the complete utilization of the heat of combustion, and the consequent production, with the minimum expenditure of fuel for maintaining the heat in the producer, of the richest quality of gas compatible with the simultaneous combustion of the fuel.

Briefly, the invention consists in confining a body of fuel in a combustion chamber situated above a portion of the apparatus in which is material capable of absorbing and giving up heat, according as hot or cold gases are passed through it; and supplying air which is heated by the passage through the regenerative material before reaching the combustion area, and causing the products of combustion, or the gas generated, to heat the regenerative material in another portion of the apparatus—steam or water being fed into the apparatus in the vicinity of the combustion area for the purpose of converting it into gas. A reversal of the direction of the flow of gases is effected from time to time, on the same general principle as in the application of regenerators to heating-furnaces.

Self-Igniting Incandescence Bodies for Gas-Burners.—Nicholls, W., of Holborn, W.C. No. 16,966; July 30, 1896.

To impregnate mantles made in the usual way, the patentee proposes to make a solution of zirconium nitrate, calcium nitrate, and ammonium nitrate, in water. To this is added a small quantity of a solution containing palladium chloride, platinum chloride, or other soluble palladium or platinum salts, and tartar emetic. Instead of these nitrates, other soluble salts of zirconium or calcium—such as the acetate or sulphate—may be used; and instead of the tartar emetic, other suitable soluble salts of antimonium—such as the chloride.

A solution found "to give excellent results in practice" is prepared as follows: 2 grammes of palladium chloride dissolved in 100 grammes of water, and 3 grammes of platinum chloride dissolved in 100 grammes of water, are each mixed with 25 grammes of tartar emetic; and 25 drops of each (or 50 drops of their mixture) are added to a solution consisting of: 12½ grammes of zirconium nitrate, 6½ grammes of calcium nitrate, and 8½ grammes of ammonium nitrate.

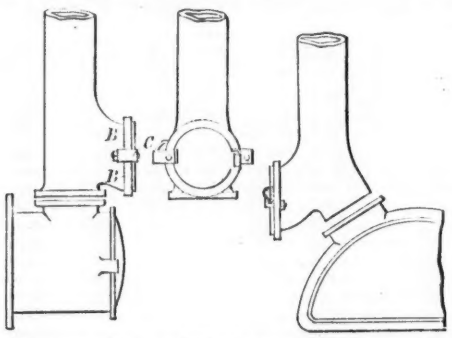
The hood or mantle, having been made to the desired form, is saturated in an aqueous solution prepared according to the above formula, and dried in the ordinary manner, when it is fit for use; the first application of a flame consuming the fibrous constituent, and leaving only the frame or skeleton of metallic oxides remaining. But, says the patentee, it will be found that a mantle made as above described will be self-lighting—that is to say, if placed over the usual bunsen burner, it will on turning on the gas ignite itself.

Incandescent Gas-Light Burners.—Clarke, A., of Albion Road, N. No. 28,122; Dec. 9, 1896.

To overcome the disadvantage existing in incandescent burners provided with a luminous flame for kindling the main atmospheric flame—viz., the deposit of carbon on the mantle—the patentee proposes to use a stop-cock in conjunction with the burner, the shell as well as the plug of which has a gas-way formed in it, and terminating at separate nozzles, with emission orifices in the mixing chamber of the burner. When the plug is turned so that there is a free passage through it, the main nozzle is supplied; otherwise the gas flows through the smaller way in the shell only, to the minor or kindling nozzle. If, however, the plug of the cock be formed with a groove in it, extending partly round its circumference, so that sufficient gas can flow around it (from an aperture connecting it with the way in the shell) to maintain a small jet from the nozzle that supplies the main flame, though the way in the plug is closed, the second nozzle may be dispensed with. In order to prevent ignition of gas within the mixing chamber, there is a wire gauze disc in the lower portion of the burner cap.

Ascension-Pipes from Gas-Retorts.—Meek, T. J., Davison, H., and Southam, J., of Manchester. No. 6; Jan. 1, 1897.

This invention—relating to ascension-pipes as used in gas-works, tar distilleries, chemical, and other works—is designed "to facilitate the deposit of carbon and tarry matter, and the easy removal of such which accumulates from time to time in the pipes and stops them up;" also to allow the pipes to be cleaned out while in work, and without the present necessity of opening the mouthpieces.



Instead of a curved or straight single ascension-pipe, the patentees propose to use a length of pipe having a short branch piece or bend projecting from the main-pipe (at or near the bottom) at any suitable angle therefrom. This branch-pipe is made as long as the various settings of retorts will allow.

The claims advanced for the "invention" are: "(1) An ascension-pipe having at or near its base an opening—the opening being independent of the retort, and forming part of the pipe; the opening to be used for the purpose of cleaning out the pipe, and for removing the deposit of tarry and other matter, &c., that accumulates in ascension-pipes during carbonization of material. (2) The combination of a pipe with a branch-piece attached, the opening of which to be sealed by a moveable lid, working in a manner so that, when opening, the orifice of the branch is gradually revealed, and not too suddenly exposed, as in the case of retort-doors, which open outwardly and expose the whole of the surface of the opening at once."

Automatically Lighting and Extinguishing Gas-Burners.—Lenze, P., of Düren, Germany. No. 7523; March 23, 1897.

As shown in the engraving—fig. 1 being a vertical section and plan of the receiver used to produce a constant pressure, and fig. 2 being a vertical and horizontal cross section of the apparatus itself—the appliance consists of a cylindrical casing A, with solid bottom and gas-tight cover D screwed thereon, which has a sleeve concentric with the vessel, and reaching nearly to the bottom. Through the bottom of the casing passes a tube R, which rises about three-fifths of the height of the casing, and is provided at the under part with screw-threads, in order to fit upon the gas-bracket or the pipe in the gas-lamp. This pipe R can be closed at the upper part by a ball-valve, or even better by a bell-valve G dipping in mercury. The bell, at the upper opening of the tube, dips with its lower edge into the mercury in a vessel fixed on the pipe R, and carries the rod I guided in a suitable manner. It is connected with a ring-shaped float S, by means of a cross-arm and rods. The float lies over the liquid in the casing. The enlargements at the bottom of the casing and on the tube R are provided in order to diminish as much as possible the space at the under part for receiving the liquid. Through the bottom reaches also a small tube E, passing through the sealing liquid to nearly under the cover of the casing.

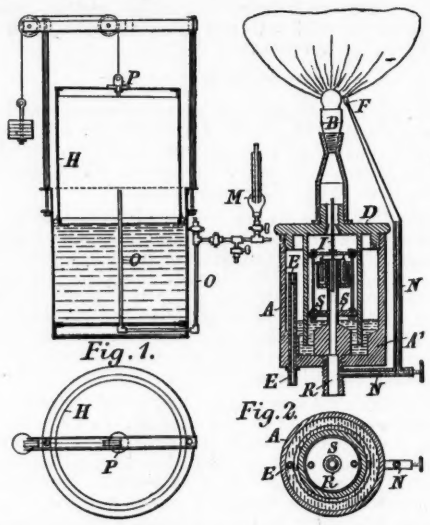


Fig. 1. Fig. 2.

When the apparatus is filled with mercury up to nearly the under side of the float, the sleeve arranged on the cover D dips into the liquid which separates with a mercury seal the two chambers formed by the sleeve in the casing. When pressure arises in the vessel, through the tube E—for instance, by means of compressed air—the pressure makes the level of the liquid fall in the exterior annular chamber between the walls of the casing and the sleeve, while the level rises simultaneously in the inner chamber within the sleeve. The float S is thus lifted, and with it the bell G; so that the gas has free access to the burner B arranged on the cover. Next to the burner is provided a pointed pilot-flame F, fed through the tube N branching under the apparatus.

With difference in the position or distance of the float from the bell or ball valve G, there must be used, with an equally high level of the sealing liquid, a different excess pressure, in order to lift the liquid up to the float and open the valve; and the appliance can thus be used to regulate for lightings which have to take place at different times.

By diminishing the pressure, the opposite effect is obtained—the sealing liquid sinks in the inner chamber, and with it the float and the valve; the passage of gas is closed; and the flame is extinguished.

The cross sections of the inner and the outer chamber are in the present case as 1 : 4, so that when the liquid level in the outer chamber is pressed down 1 mm., the level in the inner chamber rises 4 mm. The main effect of the liquid, therefore, takes place in the inner chamber possessing the float S.

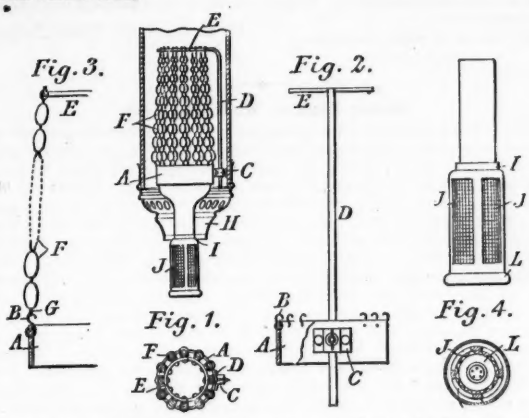
For producing a constant pressure, a vessel (fig 1) is used with a floating bell H open below, similar to a gasholder. The floating bell is provided with a counterweight, the suspension cord of which is guided over rollers and connected at P. By charging the bell with weights, the pressure can be increased at pleasure; while by increasing the counterweight, the pressure can be diminished. The connection of this receiver with the apparatus is effected by a small pipe O, in which a pressure-gauge M is provided.

Incandescent Burners.—Mayer, D., of Paris. No. 8759; April 6, 1897.

This invention consists in a construction and arrangement of incandescent mantle, in which strings of beads made of material capable of incandescence are used. Regarding his proposal, the patentee says: "By the mixture of suitable chemical substances of the well-known kinds, a compact incandescent material is obtained, which is dried and hardened and formed into particles of any suitable shape—such as spheres, cubes, cylinders, pyramids, or in clusters or bunches like grapes, tulips, and the like, of any suitable dimensions, from about 1 millimetre. The particles or grains thus produced are traversed centrally (or at one side) by one or more metallic or other suitable wires or threads, by which strings or rows of them are formed. The several strings or rows may be combined, either one above the other or side by side—that is to say, horizontally or vertically—to form the mantle. Or the incandescent grains may be arranged in zig-zag form, alternate squares, or the like. Or, in some cases, the metallic or other wires connecting them may be

omitted; the grains being then attached together before being finally mounted upon the burner."

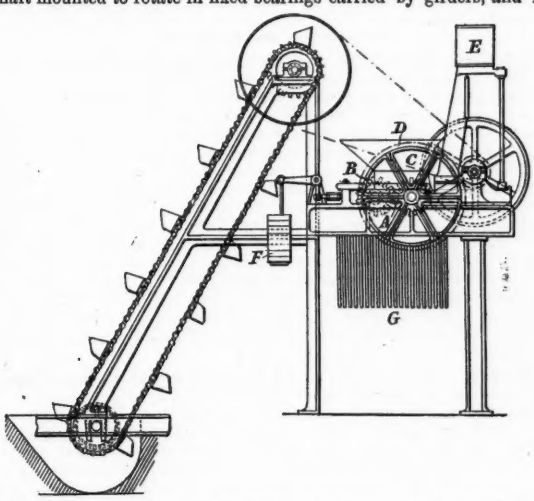
Fig. 1 is a side view and plan showing the arrangement of the incandescent material. Fig. 2 is a side view (partly in section) of the metallic support or frame. Fig. 3 shows the method of attaching the strings of incandescent beads. Fig. 4 is a side view and horizontal section of the bunsen burner used.



Round a metal ring A are arranged a number of hooks B at equal distances apart; and upon the ring is also provided a bracket C, in which a stem D, carrying a ring or top E, is fixed at the required height by a screw. The rows or strings F consist each of nine beads of the incandescent material; five rows of larger ones and four rows of smaller ones being shown, threaded upon a double wire of metal forming a loop G at one end. The gallery H is supported directly upon the shoulder I of the burner, which is provided, at the part below the gallery, with four openings J, made as high as possible, instead of the limited height ordinarily used. These openings are fitted inside with wire gauze; and in the lower part of the burner is screwed at L a gas-jet, communicating with the supply pipe, and pierced with five small holes for the passage of the gas. The object of this arrangement is to allow the admission to the burner of a much larger volume of air than is the case in ordinary burners of the kind.

Coke-Breaker.—Valon, W. A., of Ramsgate. No. 8415; April 1, 1897.

In this apparatus (shown in side elevation), there are two toothed breaking rollers A B, gearing with each other, and between which the coke to be broken is fed from a hopper C, to which it is delivered by a bucket conveyor from a pit into which it has been dumped. Each roller is made of a number of toothed metal discs or rings, arranged side by side, and clamped together on its carrying shaft. The roller A is fast on a shaft mounted to rotate in fixed bearings carried by girders, and has

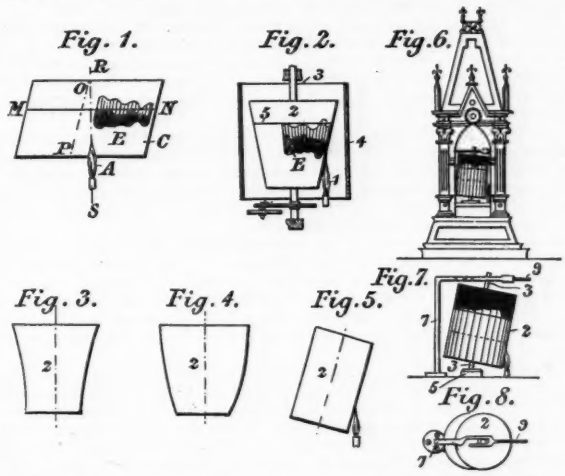


fixed to it a toothed driving-wheel D, in gear with a toothed pinion fast on the crank-shaft of a vertical motive fluid engine E. The roller B is carried by a shaft mounted in bearings, arranged to slide in guideways on the girders, but normally pressed against stops by a weight F. The arrangement is such that the rollers are normally maintained at a suitable distance apart to break coke to the required size; but in the event of a comparatively large piece of (say) iron being delivered with the coke between the rollers, the roller B will move away from the roller A against the action of the weight, and so permit the material to pass without liability of damaging either roller. Below the rollers is an inclined shoot G, the bottom of which is formed of a series of parallel bars arranged a short distance apart, to screen the small coke or breeze from the larger pieces of coke.

Photometer for Automatically Measuring and Registering the Intensity of the Light of a Gas-Flame.—W. & B. Cowan, Limited; a communication from C. V. L. Martenson, of Rio de Janeiro. No. 9041; April 9, 1897.

This invention relates to "a photometer for measuring and registering automatically the intensity of the light of a gas-flame, by means of the impress which the emitted smoke produces on an incombustible surface which is either fixed, or in motion, according to whether the flame e fixed or in motion."

Referring to the diagram fig. 1, if a flame A, produced by gas under constant pressure, be exposed to an inclined surface C, given horizontal movement in such a direction that a line M, N, perpendicular to a line of greater incline O, P, whose level is always maintained during the motion on or over a vertical line R, S, passing through the point which the flame produces—that is, through the centre of the flame—the smoke emitted by the flame must of necessity produce upon the surface in motion a characteristic impress E, of varying width, whose lower part will be heavier the slower the movement of the surface C, and which gradually decreases towards the upper part of the impress. The lower part of the impress will rise or fall (accompanying the variations of the intensity of light of the flame) according to the greater or less intensity of light produced; the width of the impress varying also in direct proportion to the intensity of the light. The lower parts of the impress can be introduced with exactness by a line, either continuous or interrupted, constituting a diagram which represents exactly the different variations through which the intensity of the light of the flame passes, during the movement of the registering surface in front of it. The line M, N, represents the relative value of the variations of the intensity of the light of the flame. So that, if this level surface becomes animated by a motion of uniform velocity, it will serve as a basis to reckon the time that has elapsed since the beginning of the operation; and the respective orders of the variations will represent the value of the intensity of light in that space of time—thus constituting a complete and exact register, obtained automatically by the flame under observation.



One method of constructing the apparatus upon this principle is illustrated in fig. 2, in which 1 is the flame under observation, 2 a cone of incombustible material, of which 3 is a vertical axis having a uniform rotary motion imparted to it by the aid of mechanism like that of a watch, or by other similar means. A glass case or cylinder 4 surrounds the cone and the flame, so that, being sheltered from all draughts, it may burn with a steady light. Upon the conical surface in motion, the flame will produce the impress already referred to; thus forming a diagram by which one can determine the variations of the intensity of the light of the flame—using for this the circle traced on the cone 2 in any convenient position, and measuring the outlines of the flame on the circle 5 in the direction of the gyrations or revolutions of the cone. The cone 2, which has its surface divided into hours, may be so turned that a complete revolution is obtained once every 24 hours; or it may be rotated so as to make one revolution per week, in which case each day's indications would be kept together.

In the apparatus described, the cone 2, which has a vertical axis, may be replaced by a cone of other form or motion—as in figs. 3 and 4, or by a cylinder with an oblique axis as fig 5.

Figs 6, 7, and 8 illustrate the apparatus with the cylinder mounted obliquely; the lower end of the axis 3 working in a bearing 5, while the upper end is free to slide within a slotted portion 6 formed on the arm of the upright 7, which is secured to the base of the apparatus. In order to vary the angle of the axis 3, the slotted portion is provided with a sliding block operated from the outside by a screw 9.

By this invention, the variations in the intensity of the light of the flame can also be determined by means of a diagram, furnished by the upper part of the dark impress, as well as deduced from the various widths of the impress, or by measuring the lines between the upper and lower parts of the impress.

APPLICATIONS FOR LETTERS PATENT.

14,946.—Foley, J. S., "A combined gas attachment and alarum clock." June 21.

15,042.—Peck, W., "Rotary gas, oil, and steam motor." June 23.

15,060.—Kaestner, C., "Acetylene gas burners." June 23.

15,110.—Simpson, S., "Dry gas-meters." June 23.

15,118.—Tugwell, G. T., "Gas-generators for gas-engines." June 24.

15,125.—Scarth, J. W., "Generation of acetylene gas." June 24.

15,233.—Duryea, J. F., "Gas-engines."

15,236.—Imray, O., "Atmospheric gas-burners." A communication from V. W. Blanchard and E. K. Stow. June 25.

15,358.—Glover, R. T., & J. G., "Coin-freed gas or other fluid meters." June 26.

15,369.—Bauweraerts, E. F. J. C., "Carburetting illuminating gas." June 26.

Driffield Gas-Works Purchase.—At a special meeting of the Driffield District Council last Thursday, a cheque was signed for £22,500 for the purchase of the undertaking of the Gas Company; that being the sum agreed upon by the valuers of the respective parties.

CORRESPONDENCE.

We are not responsible for the opinions expressed by correspondents.

Automatic Regulation of Pressure.

SIR,—With reference to Mr. Marshall's letter in your last issue, the plan I suggested eight years ago was to run a 1-inch service from the point of lowest pressure on the district to the interior of the governor bell, so that no loading of the governor would be necessary. The essential feature of Mr. Cowan's system is that he automatically regulates the load on the bell by means of the pressure of gas in a remote district—a thing which I did not contemplate. I should mention that, after writing to Mr. Marshall, I found that my suggestion had been anticipated by M. Servier, of the Paris Gas-Works, whose plan is fully illustrated and described in Clegg's "Treatise" (fifth edition, p. 266) as applied at one of the works of the Paris Gas Company.

J. L. CLOUDESLEY.

Smith Square Works, Westminster, S.W., July 3, 1897.

Naphthalene.

SIR,—I have followed with a great deal of interest Mr. Botley's experiments at Hastings on the removal of naphthalene from gas. His method of "fogging" the gas with finely divided petroleum is both ingenious and practical; but like most other methods of overcoming the naphthalene difficulty, it is misplaced—and for this reason, that it seeks to deal with an existing evil, rather than to prevent its recurrence.

I will explain my meaning more fully. Instead of seeking to remove the excess of naphthalene from the purified or partially purified gas, the cause and effect should be traced back still further, and the excess of naphthalene *prevented from ever entering the gas;* or to borrow an illustration from medicine, "The best way of curing a disease is to remove the cause."

Let us then review the whole of the facts. It is a matter of common experience to all tar distillers that, with some tars, naphthalene comes over from the stills, both at the water and naphtha periods—that is, at a far lower temperature than the boiling-point of naphthalene. Naphthalene boils at 210°C.; and yet even at temperatures lower than 100°C., naphthalene will pass over quite readily.

It is only fair to assume, then, that the tar in the hydraulic main, as at present arranged, loses some of its naphthalene in this way. Since the temperature of the tar has a direct influence upon the amount of naphthalene given off into the gas, it is evident that the root of the whole evil lies in the hydraulic main, and the proper maintenance of a low enough temperature there appears to me to be the needed remedy for this bugbear of "choked mains."

To prove how far this theory is supported by facts, I can point to two works situated only about 25 miles from each other, using exactly the same coal, realizing the same make per ton, working in much the same way, with just one exception. One works has the hydraulic main arranged in the usual way above the beds; the other carries the ascension-pipes across the retort-house to the wall, and has its hydraulic main suspended there.

Note the sequel. The first works, with its main above the beds, suffers continually and acutely from naphthalene. The second, with its hydraulic main so situated as to be well cooled, is absolutely free, both from naphthalene and stopped pipes. To effect the necessary cooling of the ordinarily arranged hydraulic main, some water cooling or jacketing arrangement could be adopted.

The remarkable ease with which naphthalene is converted into vapour, may be easily demonstrated by means of a very simple laboratory experiment. Take a small flask fitted with inlet and outlet tubes; lead the outlet-tube into a little cold water; and connect the inlet-tube to a small bellows. Then, having put a little naphthalene in the flask, place it in an open water bath. Gradually heat the water; and at the same time drive a slow and gentle current of air through the whole apparatus. It will be seen that small crystals of naphthalene appear all over the top and sides of the apparatus even before 60°C. is reached, and that they increase rapidly in quantity with increased temperature—thus showing clearly the great effect the temperature of the hydraulic main must have in determining the amount of naphthalene vapour in the gas passing through it.

Gas-Works, Norwich, July 2, 1897. FRED. E. LINGING.

The Spiral-Guided Gasholder at Chester.

SIR,—It appears necessary to make a few observations on Mr. Hunter's paper, read at the meeting of The Gas Institute, upon the columnless spiral gasholder erected at Chester, with external guides. This is perhaps more desirable as I was not given an opportunity of being present on that occasion. I must also state that I have not yet had any inspection of this particular holder; and, in the matter of such details as the number of bolts or rivets connecting the rails to the holder, I have never been consulted, either by the Engineer or the Contractors. From the description given, it is clear that the three broken bolts were due either to defects therein, or, what is more probable, to imperfectly distributed strain, whether arising from unequal tension of particular sheets during construction, or from elasticity of the tank side, as suggested by Mr. Isaac Carr in his important and able remarks. It may be well to name that the particular detail method of attaching the guides to a holder externally, which I have uniformly advised when consulted thereon, is to roll the guide-rails with an extra-broad base flange, to which the sheets can be riveted direct. I personally consider a solid drawn guide-rail of this description better, stronger, and cheaper than any plan of building up separate parts.

The chief point of importance in erecting spirally-guided holders, of either pattern, is to see that the guide-rails are fitted correctly, and parallel to each other, so that the holder is free to rise and fall with the minimum of "play" between the guide-rollers. It was clearly, I think, the fact of there being too much play at one of the guide-rollers which caused Mr. Hunter's bent axle and broken bolt-heads, whatever was the reason thereof.

Probably no great and radical change in engineering construction was ever introduced with fewer and more trifling derangements of details than in the case of the exploitation of spiral-guided holders. The æsthetical consideration is a purely subjective one, and will therefore present itself differently to different beholders. But it was well thrashed out on the first occasion of the introduction of the columnless principle at Doncaster in 1888; and it seems somewhat late in the day to revive it now. Mr. Webber, at the recent meeting, put this question in a very concise form, and effectually answered it. The *argumentum ad crumenam* was given in the paper itself.

W. GADD, C.E., F.R.M.S., &c.

64, *Barton Arcade, Manchester, July* 1, 1897.

Water Finders' Work and Fees.

SIR,—Now that the flood of criticism on water finders in general and myself in particular has somewhat subsided, and one side of the question has been fully placed before the public, I ask to be permitted, in justice to myself and my profession, to state the other side. I need not deal with the elaborate judgment of the auditor at Ampthill by whom my fees were surcharged, for that judgment carefully avoided meeting the point which is, after all, the only one in dispute—viz., whether, as a matter of fact, water finders can find water and locate springs. This point can only be decided by results; and it is by these alone that I ask to be judged. I have been employed to find water in different parts of the United Kingdom by many public bodies and private persons, and for many different purposes and objects; and I have received testimonials, too numerous for insertion here, from my employers, speaking of the excellent results which have been obtained by acting on my advice. These testimonials are from persons of undoubted veracity; and the circumstances and results in each case will bear the minutest investigation.

It only remains for me to contradict two misstatements which have appeared in the papers in relation to my work for the Ampthill Urban District Council. The first is that a boring to 700 feet without result was made on my advice. This is not the fact. A boring to a depth of 700 feet was, I believe, made at considerable expense for a Brewery Company long before I was consulted by the Council, and in a totally different locality from that in which I located the springs for the Council. If I had been consulted by the Brewery Company, I should probably have been able to save them this useless expenditure. The second is that test borings were made on my advice by the Council, and that my predictions were not verified. This again is not the fact. At the monthly meeting of the Council held on Tuesday, June 15, the Chairman, as reported in the "Bedfordshire Mercury" for June 19, said: "The Council had really tested but one of his spots"—*i.e.*, the spots at which I had located springs for the Council—"and there, where he said they would find a yield 2500 gallons, they had actually found 2800. He contended that Mr. Gataker had been treated in a very un-English way." The facts, therefore, in this particular case, which has provoked so much criticism on the water finder, have proved the accuracy of the water finder's method.

It would be a matter of great gratification to me if the whole question were investigated by some well-known scientific person or scientific body; and to such I shall be most pleased to give every opportunity of seeing me at work, and of examining the results of my method.

June 28, 1897. LEICESTER GATAKER.

Additional Capital for the Dorking Gas Company.—An extraordinary general meeting of the Dorking Gas Company was held last Tuesday to authorize the issue of additional shares. The Directors submitted a report, which showed that, in consequence of the steadily increasing consumption of gas, they were advised that during the coming winter the producing plant and storage capacity would be inadequate to meet the demands which would probably be made upon them. Having very carefully considered the position, the Board had resolved to supplement the existing plant by a water-gas apparatus and a new holder of 23,000 cubic feet capacity, at an estimated cost of £4000. To meet this, they had resolved to call up the remaining £10 unpaid on the "C" shares, which would produce £1200; and they recommended the shareholders to authorize the issue of 144 additional "C" shares of £25 each, at a premium of £10 each, and to participate in the net profits of the Company equally with the existing "C" shares up to 7 per cent. per annum. On the motion of the Chairman (Mr. J. Young), a resolution was passed agreeing to the further issue.

The Proposed Purchase of the Budleigh Salterton Gas-Works.—The proposal of the Budleigh Salterton Urban District Council for the purchase of the gas-works seems likely to be abandoned. As reported in the "JOURNAL" on the 22nd ult., the Council decided to submit the question to the decision of a meeting of ratepayers. Last Tuesday, another meeting of the Council was held, at which the Clerk (Mr. Roberts) stated that he found some difficulty in carrying out the resolution. There was no provision in the Public Health Act for the calling of a meeting of ratepayers except for certain specified objects. The question whether the Council should or should not enter into an agreement for the purchase of the gas-works was not one of the objects; and if a meeting were held, no ratepayer could demand a poll. It was therefore solely a question for the Council to decide. If they determined to enter into the proposed agreement, a Local Government Board inquiry would be held, at which any of the ratepayers would have an opportunity of objecting to the purchase being carried out. Under the circumstances, it seemed to him that if the ratepayers were opposed to the purchase, the right mode of procedure would be for them to bring their views before the Council in a memorial. By this means the true feeling of the ratepayers would be arrived at much better than by calling a public meeting. The Chairman (Mr. W. Theobald) moved a resolution to the effect that the Council should not proceed further with the proposed purchase of the gas-works, and should not oppose any application of the Company for parliamentary powers, provided that they consented to provisions fixing the standard of illuminating power, with a maximum price and sliding-scale. An amendment in favour of the purchase of the works on the terms of the agreement drawn up by the Clerk was submitted; but only the mover and seconder voted for it, while there were five against it. Some discussion followed, with the result that it was decided to call a meeting of the ratepayers, as formerly decided. The Chairman's resolution was not submitted.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Dundee Corporation Bill, East London Water Bill, New River Company Bill, Southwark and Vauxhall Water Bill, Weymouth Water Bill.

Bills read a second time and committed: Cirencester Water Bill, Swadlincote District Gas Bill.

Bills reported, with amendments: Rhymney Valley Gas and Water Bill, Tuxford and District Gas Bill.

Bills read the third time and passed: Crowborough District Water Bill, Dublin Corporation Bill, Gas Orders Confirmation Bill (No. 2).

The Newark Corporation Water Bill and the Nottingham Corporation Water Bill have been referred to a Select Committee, consisting of Lord Welby (Chairman), the Earl of Leven and Melville, the Duke of Athol, Lord Windsor, and Lord Granard; to meet on Tuesday, July 6.

The Colne Corporation Bill has been referred to a Select Committee, consisting of Viscount Portman (Chairman), Lord Seaton, Lord Hampton, Lord Home, and Lord Heneage; to meet on Tuesday, July 6.

The Corporation of Newark have petitioned against alterations in the Nottingham Corporation Water Bill.

HOUSE OF COMMONS.

Monday, June 28.

METROPOLITAN WATER COMPANIES BILL.

On the motion for the second reading of this Bill,

Mr. S. Buxton described the measure as a miserable little one, totally inadequate to fulfil the larger promises made by the members of the Government to the House, and especially to the London members. What was really wanted was that there should be an easy, expeditious, inexpensive, and decisive mode for obtaining the redress of individual grievances. But, as far as he could judge, the measure before the House did not afford this facility. At present, all the consumer who had a grievance could do was either to go to the Magistrate, or, under certain conditions, appeal to the Local Government Board. The right hon. gentleman opposite (Mr. Chaplin) now proposed to add a further tribunal, which he (Mr. Buxton) did not think would be a great advantage to the consumer, or more expeditious, but which would be more cumbersome, and unquestionably more expensive; so that the Bill, instead of redressing the grievances of consumers, would only be playing into the hands of the Water Companies. He would not oppose the second reading; but he must express regret that the Government, in dealing with the Metropolitan Water Question, had put aside purchase, and adopted a policy of delay by appointing a Commission.

Mr. Pickersgill declared that the ratepayers of London would be disappointed with the legislative efforts of the present session on the water question, particularly having regard to the fact that at the end of last session the First Lord of the Treasury informed the representatives of the ratepayers who were supporters of the Government that "next session ought not to pass without a solution being arrived at." No one could maintain that the present Bill was a "solution," or anything like it. Though the measure did a good thing in empowering local authorities to assist individuals in fighting questions of general public interest, it in no way affected the substantive rights of the Water Companies; and he wished to point out that there were two matters on which the consumers felt very strongly, and which had been entirely overlooked. The first was the hardship inflicted on them by the power given to the Companies of compelling them to pay for water which they did not receive. If the Government were willing to introduce into the Bill a couple of lines enacting that if the Companies did not supply the water charged for, whatever might be the cause of the failure, they should not be entitled to exact payment, and if they would further check the present practice of cutting off the supply and then charging exorbitantly for re-connection, while at the same time the Companies were enabled to defeat the proceedings taken thereon by the plea that the complaining parties had not paid their water-rates in advance, they would render the Bill far more effective, and much more acceptable to the people of London than it was at present.

Sir J. Lubbock remarked that the two hon. members who had endeavoured to disparage the Bill, did not represent the general opinion of the London members. The Bill did not profess to deal with the whole subject; but, so far as it went, it was a valuable measure. It was no small merit of the Bill that there was a general consensus that what was in it was good, though its opponents wished to introduce additional provisions. It was said that the East-end was in favour of purchase. But surely this was a question of price. If the undertakings of the Water Companies had been bought up, under the arrangement made some years ago by Mr. Smith, the shareholders would have had £1,100,000 in dividends more than they had actually received. He hoped the Royal Commission would lose no time in making their report. Mr. [now Sir Henry] Burdett, who spoke with such high authority, had stated—he believed with truth—that the tendency of opinion among those who had studied the question was in favour of control rather than of purchase. It would ultimately be found that the Government, by appointing the Commission and introducing this Bill, had taken the wisest course in the interest of the ratepayers of the Metropolis and the solution of the problem of the water supply of London.

Mr. L. Holland said the Bill appeared to be harmless, because if it gave little protection to the consumer it took nothing from him. If the Bill were admitted to be merely a temporary measure pending the report of the Royal Commission, it might possibly do some good; but if it were to be accepted as an excuse or argument for deferred legislation on the subject of the London Water Supply, and as a step in the direction of control as against purchase, or a full satisfaction of the popular demand for an improved system, its apparent innocence would only be turned to guile, while it would be both harmful in its policy and inadequate in its proposals. As it was, the Bill did not deal with the disadvantages of the present system of supply, and it did not alter one of the rights or duties of the Water Companies or of the consumers, but merely afforded the latter the alternative of seeking redress for any infringement of the rights they already possessed. Nevertheless, he should not vote against the second reading; all he desired was that the Bill should be accepted as a temporary measure.

Mr. Lough thought the Bill afforded a good illustration of the way in which the public hopes aroused by the original legislative programme of the present Government had been disappointed. It was urgent for the Government to do something in this important matter of the water supply of London. Last year there was a water famine in East London; and a short time since there was one in South London. These famines would recur so long as the existing system was allowed to continue.

Mr. Boulnois said he did not oppose the second reading of the Bill; but, as it had been introduced as a public measure, the Water Companies lost their opportunity of being heard on the various points raised. The Companies had no need to fear any investigation. They had endeavoured to carry out their statutory obligations in the past; and if they did not do so in the future, they were willing that the consumer should have a court before which he could lay his complaint. At the same time, the provision allowing the local authority to aid the consumer out of the rates in carrying his complaint before the court, required very serious consideration. The Companies disliked this provision, because they thought it would lead to frivolous complaints being brought forward. It was, in effect, the doctrine of maintenance; and why should it be applied to the Water Companies only, and not to the Railway and Gas Companies, and perhaps to the London General Omnibus Company? He would suggest the insertion of a safeguard, requiring a local authority to obtain the sanction of the Local Government Board or of the Attorney-General. Clause 3 (providing for the extension of the provisions of the Metropolis Water Acts to the whole area) would require careful consideration. The consumer in the outside areas would be put to expense in altering his fittings for a constant supply. He (Mr. Boulnois) should suggest certain amendments in Committee; and, as they would not interfere with the principle of the Bill, he hoped they would be favourably received.

Mr. Chaplin said the House had been told that the Bill had been introduced in consequence of the pledges given by the Government last year. This statement, however, was hardly accurate. The measure was the fulfilment of a promise he himself gave at the commencement of the session. It was perfectly true that his right hon. friend the leader of the House did express the desire of the Government to arrive at some solution of the question at the earliest possible moment; and he (Mr. Chaplin) thought they had done their best to do so. In the first place, they appointed a Royal Commission to inquire into a number of important subjects arising out of the Metropolitan Water Question which had never been thoroughly thrashed out before. In addition to this, the Government had introduced the present Bill as a more or less temporary measure, pending the report of the Commission. He did not think, therefore, it could be contended by anyone with justice or fairness that the Government had been at fault in not fulfilling their pledges. The Bill had been described on the other side of the House as a miserable and wretched measure; whereas he (Mr. Chaplin) had, it was said, spoken of it in the most grandiloquent terms. What he had said was that the Bill was a simple, modest, and very short one. Some members had done their best to disparage the Bill. But even they had been compelled to admit that there was, at all events, some good in it; and certainly the Government felt that they had no reason to complain of its general reception. The Bill did a good deal more than appeared on the surface. It was not a small matter to bring in the local authorities and give them power to initiate complaints without waiting for initiation by individuals. This was an entirely new power given to them; and complaints could now be made by single individuals. He hoped that the London Water Companies, or the great majority of them, would do their duty, and that the operation of the Bill would therefore not be extensive. Reference had been made to the late failure of the water supply of the Lambeth Company. This arose after excessive heat following on cold weather. The consequence was that there was quite an abnormal invasion of fish spawn, which blocked the filter-beds. This block had been wholly removed, though it necessarily took some time to do it. If the Companies discharged their duties, the Bill would be inoperative. There would always be a formidable body to bring them to task, and fight them upon any failure to fulfil their statutory obligations. Amendments to the Bill had been suggested; and the Government would be prepared to give due consideration to any proposals which would tend to improve the measure without interfering with its general principle and character.

Mr. Stuart did not think that what the Government were doing in this matter could be regarded as in any sense a fulfilment of what the House had understood to be their pledges. With regard to the tribunal under the Bill, he had heard many complaints that that of the Railway and Canal Commission was an extremely expensive one. Was the present Bill a fulfilment of the promise contained in the Queen's Speech, that important arrangements were to be made with regard to water supply in the Metropolis? If it was not, when and how was that promise to be carried into effect? He complained of the whole policy of which this small measure was but a part—viz., a policy of delay and unnecessary reconsideration of the question.

The Attorney-General, replying to specific questions as to cases that would be dealt with by the Bill, said, though proceedings could now be taken for the purpose of enforcing the minor duties of the Water Companies, there was no ready tribunal for dealing with the larger questions contemplated by the second sub-section of the first clause, such as the quantity, quality, and the constant supply of water. These were matters with which the Railway Commissioners were well qualified to deal; and the fears that proceedings before the Commission would be unduly expensive were not confirmed by his experience. Costs would be in the discretion of the tribunal; and if there were good grounds for complaint, the Commissioners would throw the costs upon the Companies. Under the law, as it stood at present, there were no practical means of raising the questions of the quantity and quality of water, except by proceedings for *mandamus* in the High Court of Justice; and it would not be contended that such procedure would be less costly than it would be under the Bill. The measure before the House provided a ready means of remedy for serious complaints on the points mentioned.

Mr. Lowles regarded the Bill as a real concession, especially to the

East-end of London, which had suffered from water famine; and he thought the Government had acted wisely in trying to settle the question once for all on a firm basis by means of a Commission of experts. He believed the measure would have a preventive effect, and be of great use to water consumers.

Lord H. Cecil pointed out the advantages of proceeding by the method of control rather than purchase. It was impossible, he said, to resist the temptation of pointing a moral and adorning a tale, because beyond all doubt the reason of many complainants, inside and outside the House, disliking the method of expropriation was that they distrusted the London County Council, and were therefore reluctant to do anything that would place the water administration in the Council's hands. The extraordinary want of tact on their part had created against them a prejudice which would destroy the utility expected from so important a public body. The method of proceeding by control had the advantage of compelling became law, the Government would have no hesitation in compelling the the existing authority to do its duty; and he hoped that, when the Bill Water Companies to perform their proper functions. There was one power which he thought might have been added to the Bill, and which, perhaps, the Government would consider when they came to the Committee stage. This was granting to the Railway Commission the power to deal with the question of water-rates in cases where the water had been defectively supplied, whether in point of quality or quantity. Nothing had struck people as being more conspicuously unfair and unreasonable in connection with the Water Companies than their action in exacting the full amount of their rates when, through frost or drought, they had been unable to supply the full measure of water. It would be an advantage if a clause could be inserted in the Bill which would enable the Commission to make an order for decreased water-rates in proportion to the diminution that had taken place in the quantity of water supplied. He thought this would be an eminently fair regulation, and would give a sensible relief to the aggrieved water consumer. It would also act as a kind of automatic penalty of which the Water Companies would be afraid, and which they would take the utmost trouble to escape. Some amendments of the kind he had indicated would, he thought, improve the Bill. But he was convinced that he was only reflecting the opinion of his constituents (Greenwich) when he said that the great majority of those who had complained, and very reasonably complained, of the action of the Water Companies in the past would feel that the Government had taken a great step towards removing their grievances by introducing a measure which would establish effective control over the Companies.

The Bill was then read a second time.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Gravesend and Milton Water Bill, Water Orders Confirmation Bill.

Bills read a second time and committed: Belfast Water Bill, Metropolitan Water Companies Bill.

Bills reported, with amendments: Duntocher and Dalmuir Water Provisional Order Bill, Eastbourne Water Bill, Kingston-upon-Hull Corporation Bill, New Hunstanton Water and Gas Bill, Newport Corporation Bill.

Bill reported [preamble not proved]: St. Anne's-on-the-Sea Gas Bill.

Bills read the third time and passed: Carnarvon Corporation Bill, Dundee Corporation Bill, New River Company Bill, Southwark and Vauxhall Water Bill.

The Great Western Railway Company have withdrawn their petition against the Malvern Link Urban District Gas Bill.

HOUSE OF COMMONS COMMITTEE.

Wednesday, June 2.

(*Before Mr.* Rankin, *Chairman, Mr.* Reckitt, *Mr.* S. Smith, *and Mr.* Newdigate.)

EAST LONDON WATER BILL.

This Bill, which is to authorize the East London Water Company to construct additional works and raise further capital by the issue of debenture stock, was further considered by the Committee. The case for the opponents was now proceeded with; evidence in support of the petition of the Earl of Meath being taken first.

Mr. *Paulton*, M.P., in reply to Mr. Blennerhassett, said he was a member of the Commons Preservation Society, and had been asked to undertake opposition to the Bill with a view to preventing the destruction of the open space at Tottenham. He was asked to move the rejection of the Bill on its second reading, on the ground that it was a serious interference with a Metropolitan common; but the promoters strongly urged that this course should not be followed, because it might cause another water famine in East London. He then inquired into the circumstances; and he eventually moved the instruction to which Mr. Pember had alluded in his opening speech, and which he explained fully to the House. The House quite understood that the lands were Lammas lands. The object of the instruction was merely to carry out the policy of Parliament as established in previous sessions, and to make it obligatory on the Company to substitute an equivalent area of land for public use for the land they proposed to take. He was anxious that they should provide land and not money. The promoters—Colonel Lockwood, M.P., in particular, who was one of the Directors of the Company—fully accepted the instruction.

Cross-examined: Beyond the fact that people walked across the site of the reservoirs, he had nothing to show that the public had exercised rights over that land.

Mr. *Shaw Lefevre*, examined by Mr. Blennerhassett, said he had taken great interest in the preservation of public open spaces, and had been Chairman of the Commons Preservation Society, with the exception of a few years, since 1875. He was a member of the Select Committee of the House of Commons on the subject of the open spaces of the Metropolis in 1865. For the purposes of the Committee, a return was ordered of all commons and open spaces within 15 miles of London; and Tottenham Marshes were included in the return. The Committee arrived at the conclusion that there was no common land within 15 miles of London which could be spared in the interests of the population; and if this was true then, it was much more so now, owing to the increase of population. There was no distinction in law between common and Lammas lands. The report of the Committee was followed in 1866 by the Metropolis Commons Act, which was in strict accordance with the recommendations of the Committee. A doubt arose as to whether the Act applied to Lammas lands; and in 1869 another Act was obtained definitely extending the previous Act to such lands. He did not think it was reasonable to authorize the Company to take these lands at Tottenham; but if it should be necessary for the Water Company to make the proposed reservoirs, the obligation should be put upon them to give equivalent land in exchange. If the Company could make reservoirs elsewhere, so as not to interfere with this open land, they should be compelled to do so.

Mr. *Birkett*, the Solicitor to the Metropolitan Public Gardens Association and to the Commons Preservation Society, was taken by Mr. Blennerhassett through the various proceedings of these Societies in regard to open spaces, and was also examined at great length with reference to the various Acts relating to commons and Lammas lands. He said he had made inquiries, and had found that higher up the River Lea, at Edmonton and Enfield, there were spaces where he was satisfied the reservoirs could be constructed, without interfering with Lammas lands; but if it were necessary to locate them on the present site, the Company should be obliged to provide an equivalent area in the district.

Mr. Pember (in cross-examination): Which do you think is the most important thing, that the water supply of the million and more people in the East-end of London should be rendered secure, or that some imaginary possibility of these water-logged lands being turned into recreation-grounds should be preserved?

Witness: I am, of course, as you know, an advocate for open spaces. In my judgment, that open space is every bit as necessary for Tottenham as the water supply for London.

Mr. *Holmes*, the Secretary to the Metropolitan Public Gardens Association, and Mr. *J. Cloudesley*, a member of the Tottenham Urban District Council, also gave evidence in relation to the Lammas lands at Tottenham Marshes.

Mr. Blennerhassett then addressed the Committee on behalf of the petition of the Earl of Meath. The proposal he asserted was simply an attempt to over-ride by a Private Act the public law of the country. If he established this proposition, apart from the instruction of the House—which the promoters admitted was mandatory—he should be entitled to ask the Committee to say that the preamble had not been proved. The first position taken up was that the instruction from the House had been obtained under a misconception, that it referred to common rights, and that no common rights were to be extinguished. It amounted to something very like a breach of faith on the part of the Company that they should have obtained the second reading of their Bill through accepting the Instruction, and now, to meet it, proposed the clause to which Mr. Pember had referred in opening—a clause which was an insult to both the Committee and to the House of Commons. It was as follows:—

> Within six months after the passing of this Act, the value of any common rights proposed to be extinguished (other than common rights or other rights in respect of which the Company will be bound to make compensation under the Lands Clauses Act to persons individually entitled to such rights) shall be ascertained by an arbitrator to be appointed by the Board of Agriculture; and the amount of the same, when so ascertained, shall be paid over by the Company to the Board of Agriculture, and shall be, under the direction of the said Board, applied in the purchase of a suitable area of open space to be substituted for such common rights aforesaid; or the said Board may, if they think fit, transfer the amount in their hands to the Tottenham Urban District Council, to be dealt with by that Board under sections 6 & 7 of the Tottenham Improvement Act, 1890.

If this clause were agreed to, they would have to compensate the owners of the soil and the owners of the Lammas rights; and nothing would be done in respect of the common rights extinguished. Mr. Pember said this was not common land, because the public had no right over it. If this argument were good, only the private owners would get compensation, according to the wording of the clause. Therefore it was that he said the clause was an absolute sham. No case of emergency had been made out. The Bill was simply a provision for future years; and no suggestion was made that if it was not passed there would be a likelihood of another water famine. Therefore the Committee would not incur any responsibility by deciding that if the Company needed the reservoirs, they must first of all comply with the general law of the country.

Lord R. Cecil, for the Middlesex County Council, said if the land proposed to be taken was common, the Bill should not be passed—at any rate in its present form. This appeared to be admitted by Mr. Pember; for his argument in introducing the Bill was based on the fact that it was not going to deprive the public of any right. As for the clause that the promoters had produced, it seemed to him that it did not at all carry out the instruction to the Committee. If the promoters produced a Bill that could not be passed without infringing the practice of Parliament, it was monstrous for them to throw the blame of its rejection on the petitioners, and say they were preventing East London from being supplied with water.

Mr. Pember, in reply, said the matter still remained in this position—that, acting upon the best engineering advice available, the East London Company in 1892 formed a large scheme which they laid before the Royal Commission in the same year for the purpose of making reservoirs along the Lea Valley, and so ensuring in the future an adequate supply of water for their district. This scheme was laid out by Mr. Bryan, their Engineer, with great skill, and in such a manner that from time to time, as required, portions of it could be proceeded with. Mr. Bryan had told them that they could not make the reservoirs satisfactorily otherwise than along the low level of the Lea Valley, or without interfering with Lammas lands. They might urge that a portion of the scheme could be carried out in another part of the district; but this would interfere not merely with the general scheme, but very likely with engineering details, which it had not been necessary to go into in the present proceedings. It was evident that the whole of the scheme could not be carried out in the Lea Valley without having, sooner or later, to deal with the question as they had done that morning. He was accused of trying to over-ride the

general law. But from the common-sense point of view the arguments were strongly in his favour. Which was the more important—the maintenance of the security of the water supply of about 1¼ millions of people, or the maintenance of the possibility, some day or other, of these water-logged lands (and it could only be done at enormous cost) being turned into a recreation-ground? But for the instruction of the House, this would be the only issue the Committee would have to try. It was suggested that these lands were wanted for a commercial speculation. He only wished they were, but as they all knew, they were required merely to enable the Company to provide, in the fullest meaning of the word, water to fulfil their statutory obligations. He passed on to point out the extreme unfairness of the burden which would be imposed by the conditions which the Committee were asked to attach to their sanction of the scheme. The contention was that the Company should buy the land in the ordinary way—compensating to the full the owners of the soil and the owners of the Lammas rights—and then that they should purchase other land of equal area, which, having regard to the character of the marshes, would probably cost two or three times as much as the marsh land. Would this, he asked, be making such provision for open space as, in the Committee's judgment, ought to be fairly substituted for the common rights proposed to be extinguished—which common rights would be purchased in hard cash? This acquisition of another equivalent area, at a very high figure, would be effected for something over and above the common rights they extinguished; it would not be for common rights, but for the supposed, but non-existent, rights of the public. He detailed the steps connected with the acceptance by Colonel Lockwood of Mr. Paulton's instruction, which, such as it was, had, he said, to be obeyed in form. The promoters believed, as already stated, that there were no public rights; but if, over and above the private rights referred to, there were any public rights, and an arbitrator could put a value upon them, the Company would pay for them. Surely the clause suggested provided all that justice and common sense demanded in carrying out the instruction. To say that they should provide 98 acres in lieu of the space taken would be a grievous burden on the Company, and one which he could not recommend them to submit to, especially having regard to the fact that the present proposals were only part of an extensive scheme, and that what would hold good for this portion of it would do so for other sections. It would be setting a precedent which would affect not merely the East London Water Company but all others. If the Committee regarded the lands in question as an open space, and wished to preserve them as a "lung" of London, then the Company would not be acting in opposition to their wishes, for the ground though covered with water would still be open. Under the circumstances, he asked the Committee not to put any condition on the Company which would prevent them taking the Bill.

The room was then cleared. On the re-admission of the public,

The Chairman said: The Committee have decided that the preamble of the Bill, so far as the position of the reservoirs is concerned, is proved—on this condition, that the Water Company either hand over to the Local Authority 25 acres of land in fee simple, taken from the area of the proposed reservoirs, for the purpose of making recreation-grounds, or, if more convenient to the Company, that they shall acquire a similar extent of land—namely, 25 acres—elsewhere in the neighbourhood, and assign such land to the Local Authority for recreation purposes. They also decide that the Board of Agriculture be asked to appoint an arbitrator to decide where such land ought to be situated, unless it can be agreed upon between the Company and the Local Authority of the district. In giving this decision, the Committee believe they are carrying out the spirit and fully answering the requirements of the instruction moved in the House of Commons, and of the recommendations of the Board of Agriculture.

Thursday, June 3.

Mr. Balfour Browne, in addressing the Committee, directed special attention to clause 14 of the Bill, which provides for the use by one Company of another Company's works, and gives power for one Company to supply another in case of necessity. It was admitted that this was absolutely in contravention of section 59 of the Staines Reservoirs Act of 1896, under which water taken from the Thames by the Joint Committee of the three Companies concerned in that Act was to be used for the supply of the districts of those Companies only, and should not be supplied to any other of the Water Companies, or any other body. Was it necessary for the Company to have this power? They had heard Mr. Bryan, the Engineer to the Company, say that they had already lent the use of their 34-inch main to the Grand Junction Company. If they could lend their works in this way, the clause was unnecessary. Then Mr. Bryan said they also wanted it to meet a shortness such as occurred in 1895, when the New River Company came to the assistance of the East London Company, and supplied them with water at cost price. This was a very proper action; but if it could be done already, the clause in this respect again was unnecessary. It certainly seemed to him that the only two things for which the clause was asked, the Company were already doing. The evidence was that they only wanted to exercise the power in an emergency; but the clause was unlimited, and it was quite absurd to give power, available at all times, when it was only required for an emergency. There was no objection, so far as he could see, to allowing the Companies to use each other's works, or supply one another with water in case of emergency. But who was to judge of the emergency? Surely it should not be the Companies themselves. It ought to be some public body—say, the Local Government Board.

Mr. Baggallay remarked that he was prepared absolutely to abide by what Mr. Bryan and the other witnesses had said, and to limit the clause so that the interchange of powers should only be exercised in case of emergency.

Mr. Balfour Browne said this to some extent would meet his views. They would remember that Mr. Bryan said the New River Company supplied them at cost price. If the clause was merely to meet an emergency, the Companies ought not to be allowed to make a profit out of such a transaction. Without some modification, the effect of the clause might be to materially enhance the value of the Companies in case of purchase hereafter. Purchase was still in the air; and it would be wrong of Parliament to forestall any such question that might arise in the future. He therefore urged that the water, when supplied, should not be held to enhance in any way the value either of the company buying or of the company selling it. Whenever purchase did come—and he thought it would some day—the purchase would be upon the basis of the maintainable revenue. This clause would certainly help the Companies to increase their revenue, and thus enhance their value. This was not the intention of Parliament; nor was it the intention of the Company, for Mr. Bryan told them that when inserting the clause he had no financial considerations in his mind. As showing what the view of Parliament was on the point, Counsel referred to a clause of the Staines Reservoirs Act of 1896, which provided that, if the undertakings of any of the three Companies be purchased within seven years from the passing of the Act, otherwise than by agreement, by any public body or trustee, no claim for any advantages conferred by the Act should be allowed. This obviously was to prevent the Arbitrator, in case of purchase, from having regard to financial advantages conferred by the Act. The seven-year limit in that case was fair enough, because large works costing a million of money were authorized; and it would be a hard thing that for all time this money should be ignored. But in the present case, there were no works concerned, save what were already in existence; and therefore the argument did not apply.

Mr. Baggallay was quite ready to accept the suggestion that the clause should be confined to cases of emergency; and that the Local Government Board should be the judges both as to the emergency and as to the length of time the water should be supplied in each particular case.

Mr. Balfour Browne said that would meet his views.

The Chairman, after conferring with the other members of the Committee, announced that the amendments suggested would be satisfactory to them.

Lord R. Cecil said the first point he wished to bring before the Committee was the question of wells, which had been discussed in the New River Bill. Under section 12 of the Act of 1886, the East London Company had a general and unlimited power to sink wells; the only restraint being the want of capital. Then, under the present Bill, the balance of capital raised and not expended on the works might be applied to any of the purposes particularly specified, or to the general purposes of the undertaking of the Company to which capital was applicable. Supposing the Company employed all the capital they expected to use for the various purposes of the Bill, they would still have £10,000 balance, which he admitted was not a very large sum. If, however, the Company could save anything on the other works, or if they abandoned any of them, a large sum might be available for sinking wells. The Middlesex County Council regarded this as a most serious matter, because, in giving indefinite power of well-sinking of this kind, there was no telling how much injury might be done underground to other water supplies. He therefore suggested that a specific clause should be inserted, preventing the sinking of wells, or that the latter word of the present clause, as to the balance of capital being available for the general purposes of the undertaking to which capital was applicable, should be struck out. Then he said that the two Companies—the New River and the East London—were taking a great deal too much water from the Lea.

The Chairman: They are not taking any more water than they are entitled to.

Lord R. Cecil: That is true. They were entitled to the whole flow, subject to sending a certain quantity down for navigation purposes. The report of the Royal Commission said that, even with greater storage capacity, the quantity taken from the Lea should in no case be more than 52½ million gallons daily; but they had it from Mr. Bryan that the Companies had taken as much as 52,870,000 gallons in a day. It was evident, therefore, that the Companies were abstracting more than their proper quantity; and he urged that they should be restricted to the 52½ million gallons. In conclusion, he asked the Committee to express an opinion that the Company should comply with the regulations laid down by the Royal Commission.

Mr. Baggallay suggested, with regard to the sinking of wells, a slight verbal alteration, which he thought would give the protection Lord R. Cecil sought. He objected to the power to apply surplus capital to general purposes being struck out, because there must be a little free capital to cover minor expenses, such as the promotion of the present Bill.

Lord R. Cecil remarked that the proposed verbal alteration would not effect the object he had in view.

Mr. Baggallay said if this would not satisfy him, he (the speaker) would have to stand on the same ground as in the New River case. He took no power under the present Bill to apply capital to the sinking of wells; and he did not propose to sink wells. But such powers as he had under the common law, or under the Company's existing Acts, he declined to give up. With regard to taking water from the River Lea, he thought Lord R. Cecil had quite misunderstood the report of the Commission.

The Chairman: I think you need not go into that.

Mr. Baggallay said there was then the question of regulations. He did not know whether he need pursue that.

The Chairman: I understood that you had the regulations; and that they were carried out by the Company, but not under any statutory power.

Mr. Baggallay: That is so.

Lord R. Cecil: Have you any objection to being bound to allow the Inspector to inspect your works?

Mr. Baggallay: I think he has the power under the Metropolis Water Acts.

Lord R. Cecil: He has no power to do so.

The Chairman: In the report it says: The Examiner is only admitted to the works on sufferance.

Mr. Baggallay: I think that is right. He has no power; but he had always been treated as if he had. He should object to put such power in the Bill, except on the request of the Local Government Board, under whom the Water Examiner acted. If applicable at all, the power should be applied to all the other Companies. The point was raised on the East London Bill of 1894; but the Committee then decided not to insert the provision.

The Chairman, after consultation, said: The Committee have come to the conclusion that the precedent of the New River Company with regard to the limiting of capital ought to be carried out; and they think it can be carried out by striking out the words "or for the general purposes of the undertaking of the Company." They think they cannot interfere in

any way with the privilege of taking water from the River Lea which the Company now possess; nor do they think it necessary to interfere with the position of the Examiner as it now stands.

Mr. LITTLER then addressed the Committee with regard to the sinking fund clause. Since the sinking fund clause had been invented, it had always been in the same form. Now the Company proposed to alter the clause, not only from the ordinary form, but from the form which the promoters themselves thought was right at the time they introduced the Bill. The proposal was that until a certain time after the whole of the works were completed, the sinking fund should not be operative; so that, although they might complete one reservoir and bring it into use, it would not be until the other was also finished that the contributions to the fund would begin. He gathered that the Committee desired to keep the clause in the same shape as hitherto.

The CHAIRMAN: We did alter it in the case of the New River Company.

Mr. LITTLER said the moment these works were finished, they would begin to produce money, because they would enable new districts to be supplied. Therefore the reason for altering in the case of the New River Company did not apply here.

Mr. BAGGALLAY said he was content to take the clause as inserted in the New River Bill.

Mr. BALFOUR BROWNE also briefly addressed the Committee on the subject of the sinking fund clause.

Mr. BAGGALLAY said he was willing to modify the clause, so that there should be no doubt that it would operate from the time the Company began to make use of one of the reservoirs. If that was not satisfactory, he asked the Committee to adhere to the clause as in the New River Bill.

The CHAIRMAN, after a brief consultation with his colleagues, said: The Committee are of opinion that the alteration which was made in the sinking fund clause we are now considering, and which was placed in the New River Bill, is a great improvement over the old one. I remember the discussions on that old clause very well, because I happened to be a member of the Committee before whom they took place; and I do not know that it was as well understood then as it is now. The Committee think it is more just as amended in the Bill of the New River Company; and they have decided therefore that in this Bill it shall be introduced substantially in the same form. But they think that, as far as this Bill is concerned, there should be introduced into the clause some words which should make the sinking fund contribution commence from the period when the works begin to supply water to customers. I think the works should be specified. It was understood, he added, that the decision of the Committee referred only to the capital embarked in each particular work.

Mr. BAGGALLAY: As the capital embarked in each particular work is brought into use then the sinking fund contribution begins in respect of the capital.

The CHAIRMAN: Yes.

The preamble was then formally declared proved; and it was arranged to take the clauses next day.

Friday, June 4.

The clause stage of the Bill was taken to-day.

To meet the decision of the Committee with regard to clause 14, the following proviso was added, Counsel on both sides agreeing: "Provided always that such supply shall only be given or taken in cases of emergency, with the consent of the Local Government Board, and during such period or periods as the Local Government Board may from time to time prescribe."

Mr. PEMBER then brought up a clause with reference to the Lammas lands.

Mr. BLENNERHASSETT said under the clause the 25 acres might not be handed over till after the reservoirs had been completed, which time they were told would be seven years hence. He wished the Company to be directed to provide the land within six months of their entering on the Lammas lands.

Mr. PEMBER said it would be impracticable and foolish to give the 25 acres of the Lammas lands in their present swampy condition. The Engineer intended to place the soil raised in excavating the reservoirs on the 25 acres, and thus raise and vastly improve the land; benefiting both the public and himself at the same time.

Mr. BRYAN said if the Company were to give the land at once it would be handed over at its present level, and would remain water-logged; whereas if they were allowed to give it later, the land would be raised, and the area made available for recreation purposes all the year through.

The matter was discussed at some length. Eventually a clause was agreed to under which the land was to be given on completion of the works; the site to be at the south end of the reservoirs, or between them on the Tottenham side within the limits of deviation; the level of the land to be raised above flood-level, and the surface to be levelled.

Mr. BAGGALLAY then handed in the following clause with reference to the sinking fund, which he said had been agreed to by all parties concerned:—

(1) At the end of the half year in which the Company first supply water to their consumers through, or by means of, any of the following works respectively—that is to say, from the reservoirs Nos. 1 and 2 by this Act authorized or either of them or from the works connected therewith or from the new main to be connected to the Company's Thames main in St. Mary, Islington—and at the end of each succeeding year, the Company shall carry to a sinking fund in each year such percentage on such amount of debenture stock then issued under the powers of this Act and certified by the Auditor to have been issued and applied for the purposes of the work or works from which water is so supplied, and any premiums received thereon as shall be equal to the excess of the average percentage of the dividend or interest paid for that year on all the capital of the Company, whether ordinary stock or debenture stock, with any premiums received thereon above the rate of interest at which debenture stock under this Act was issued, together with an additional one per centum per annum added thereto for management, such sinking fund to be held and applied by the Chamberlain of the City of London as Trustee, for the purpose of purchasing and holding stock of the Company, and of investing the dividends thereon, with a view to ultimately extinguishing the capital of the Company, or for such other purposes as Parliament may from time to time determine. No stock so purchased and held shall confer any right of voting at any meeting of the Company. Provided that in the event of any debenture stock created under this Act being issued below par, the percentage to be carried to the sinking fund shall in respect of such debenture stock so issued below par be calculated on the amount of money raised by such debenture stock, instead of on the nominal amount of such debenture stock. (2) In the event of the undertaking of the Company being acquired by a public authority, the allowance of one per centum for management shall not be deemed to have increased the capital value of the undertaking or be the subject of compensation or purchase.

The remaining clauses of the Bill were then gone through; only alterations and additions of minor importance being made.

The Committee subsequently reported to the House that a report from the Local Government Board had been referred to, and considered by, them; and that they had inserted in the Bill a clause with regard to the allocation of capital, which appeared to them to give effect to the recommendation contained in the report. A report from the Board of Agriculture, as to certain common or commonable lands proposed to be taken under the powers of the Bill, had also been referred to the Committee; they inserted in the Bill a provision carrying out the recommendation contained in the report. In pursuance of the instruction of the House of the 26th of February last, they inserted such provisions as will ensure the acquisition by the Local Authority of such a suitable area of open space as, in their judgment, ought fairly to be substituted for any common rights which may be extinguished under the Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Saturday, June 19.

(*Before Justices* HAWKINS *and* WRIGHT.)

Grand Junction Water-Works Company v. Davies.

This was a special case stated by Justices, raising a question as to the valuation of a tenement under the Water-Works Clauses Act, 1847, and the Company's Special Act.*

Mr. BOSANQUET, Q.C., and Mr. RAM appeared for the appellants; Mr. F. LOW and Mr. SHORTT represented the respondent.

Mr. BOSANQUET said the question raised was whether the whole of the tenement—*i.e.*, the house and the whole curtilage—had to be valued for the purpose of assessing the water-rate, or whether, as the Justices had decided, they might, in their discretion, take off a portion of the premises which they thought need not have been used as part of the curtilage, but might have been let off separately if another entrance had been made. The case set out the section of the Act of 1847, which provides that any dispute as to the valuation of a tenement shall be decided by two Justices; and it then went on to say that No. 1, Grange Road, Ealing, was supplied with water by the appellants, and was owned and occupied by the respondent. It recited the various sections of the Company's Special Act, which fixed the charges to be made; and defined what were not "domestic purposes"—gardens being included—and provided for the supply by meter or by agreement in certain cases. It gave a description of the premises in question, which consisted of a dwelling-house with a gravel approach in front and a garden at the back; a portion being a kitchen garden, with a greenhouse and tool-shed. The whole was occupied by the respondent as his residence; and the gardens and other appurtenances formed part of the curtilage. The total area was a little more than half an acre. Annexed to the case was a plan on which was marked in blue a portion of the garden at the back which the Justices, in their discretion, had cut off, because they said it might have been separated and let apart by making another entrance. The respondent was supplied with water for domestic purposes, and he had also, under threat of legal proceedings, paid the appellants the sum of one guinea for the use of the water for the garden in 1896. The question at issue was what should be taken into account in determining the annual value of the tenement. For the appellants, it was contended that the tenement was the whole area of the premises occupied; for the respondent, that the tenement, the annual value of which was to be determined, was the dwelling-house alone, and that the garden ought to be excluded. The witnesses for the respondent stated that the garden would have a letting value apart from the house, if separate entrances were made; while those for the appellants asserted that, even if such alterations were possible, the whole character of the premises would be changed. The Justices found, as a fact, that the annual value of the whole tenement, as occupied by the respondent, was £100, but that the annual value if a certain portion of the garden fronting on Grange Road were excluded was £80; and they found that such part might be separately let. They were of opinion that neither the appellants' nor the respondent's contention was correct, but that in arriving at the annual value, they ought to make a special assessment for the water-rate, and only for the purpose of the domestic supply; and that they must therefore determine what quantity of garden should reasonably go with the house. They were further of opinion that they ought to consider that the garden was by statute expressly excluded from receiving water under the head of "domestic purposes," but that, in accordance with the case of *The Bristol Water-Works Company v. Uren*, and cases therein cited, a reasonable amount of garden must be included in the assessment on which the charge for water for domestic purposes was made. Having regard to the facts proved in the case, it appeared to them that an appreciable area beyond what was reasonable and necessary for the enjoyment of the dwelling-house, having regard to its character and locality, could be severed, and form a separate unit for assessment. They therefore assessed the value at £80. If the appellants' contention were held to prevail, and the whole of the premises had to be valued, the figure was to be raised to £100; but if the respondent's argument were approved, and the whole of the garden were to be disregarded, the case was to be remitted.

At the conclusion of the arguments, their Lordships reserved judgment.

Saturday, July 3.

The decision of their Lordships was given this morning.

Justice HAWKINS delivered judgment; stating that Mr. Justice Wright had had an opportunity of seeing it, and had quite agreed with it. After

* See "JOURNAL," Vol. LXVIII., p. 1139.

reciting the description of the premises as set out in the special case, and referring to the sections, he said the question, as stated in paragraph 9 of the case, was what was to be considered in determining the annual value of the premises in question. The appellants contended that the whole area of the premises occupied by the respondent as one undivided tenement ought to be taken into account; whereas the respondent contended that the dwelling-house alone ought to be considered, and the garden excluded. After hearing evidence, the Justices found that the annual value of the whole was £100; but that a portion of the garden, though not in any way divided or separated from the rest of the premises, and though occupied as part, and desirable for the enjoyment of the premises, might, by making entrances, cutting off a great part of the kitchen garden, one greenhouse, a portion of a fowl-house, and a coach and bicycle house, have been separately let. According to this view, the annual value should be, and was reduced to, £80. In his (Justice Hawkins's) opinion, the Justices had no jurisdiction to exclude such portion of the garden, &c., from their consideration in determining the annual value of the tenement supplied with water. The 68th section of the Act of 1847 did not confer upon the Justices any authority to curtail the area or alter the boundaries of the existing tenement, or to reduce the limits of the garden to the extent they thought should reasonably go with the house, by making alterations which were never contemplated by the owner or occupier, and which could not be carried out without substantial operations. The Act regarded only the value of the existing tenement as the owner and occupier up to the present time had chosen to enjoy it. The whole, in his Lordship's opinion, formed the residential tenement; and this was the tenement supplied with water. If the owner and occupier desired to curtail the area, they could do so for themselves; and when, if at all, they had done so, they would be entitled, as of right, to the valuation of the curtailed area. The reported cases mentioned in the course of the argument did not throw much light on the question before the Court; yet they might be usefully referred to. In *The West Middlesex Water Company v. Coleman*,* the question turned on the case of where water was supplied to a licensed public-house; the Company contending that, in assessing the annual value as the basis for the water-rate, the fact that the premises were licensed should be taken into consideration, and that the rate should be based on their value for domestic purposes. In *The Bristol Water-Works Company v. Uren*,† Mr. Justice A. L. Smith intimated the view of himself and Mr. Justice Mathew as being that a garden forming part of the amenities of a dwelling-house, and so occupied with it, should be treated as added to the house in assessing the value of that house. With this view he (Justice Hawkins) entirely agreed. The case of *Lowe v. The Lambeth Water-Works Company*, decided by the late Sir George Jessel, had been referred to; but it did not seem to have been reported. In their judgment, the Justices were wrong; and the assessment must be raised to £100.

Mr. SHORTT asked for leave to appeal, as it was, he said, a very important matter.

Justice HAWKINS declined to accede to the application.

Mr. RAM asked for the costs in that Court and in the Court below.

Justice HAWKINS said the appellants would have the costs in that Court, and if he had jurisdiction over those in the Court below he should certainly allow them in the same way.

HIGH COURT OF JUSTICE—OFFICIAL REFEREE'S COURT.

Plymouth—Tuesday, June 29.

(*Before Mr.* E. POLLOCK.)

The Alleged Nuisance at the Plymouth Gas-Works.

To-day the Official Referee resumed his inquiry respecting the claim by Mr. W. Osmond Ward, who carries on the business of a tanner in premises adjoining the Plymouth Gas-Works, to recover damages against the Plymouth and Stonehouse Gas Company for injury done to his business by the alleged escape of dirt and smuts from their works. The hearing was commenced on Friday, May 7, and continued to Tuesday, May 11, when it was adjourned.‡

Mr. M'CALL, Q.C., and Mr. GRAHAM appeared for the plaintiff; Mr. CHANNELL, Q.C., and Mr. DUKE represented the Company.

Plaintiff, recalled and further examined by Mr. M'CALL, said that, since he was examined on the previous occasion, the nuisance complained of had continued.

Mr. CHANNELL: I understand you to have sworn in your affidavit that the nuisance has become worse since the former action?

Witness: No. In calm weather, it is slightly better; in rough weather, it is worse. In calm weather, the iron roof intercepts a certain quantity of particles, and prevents them reaching our premises.

The OFFICIAL REFEREE: On the whole, it is worse?

Witness: No; I do not say that.

Mr. CHANNELL (in cross-examination): Is it better or worse since the last inquiry?

Witness: I do not think there is any improvement. Dirt is deposited on our premises in calm weather, and is disturbed in rough weather.

And all of it is from the gas-works?—Yes; I do not believe it is affected by road dust or by dust or dirt from the railway.

Certainly none from your own chimney?—Certainly not. That is my opinion.

Nor from anywhere else except the gas-works?—That is my opinion. The nuisance arises when the wind is from the south or south-east. When the Official Referee visited the works on the 7th of May, dust was swept up from some tables hard by for experimental purposes. Those tables had not been swept down for a week.

Answering further questions, witness did not know the prevailing wind during that period. It might be true that in a diary kept by Adams there was a record of dust and smuts with the wind in the opposite direction from that which usually brought dirt; but there might have been a southerly wind before that. There was dust on some of the butts when the Official Referee visited the works on the previous (Monday) evening. This dust had accumulated since three o'clock on the same afternoon. It came from the gas-works, and was exactly the same kind of dust as had been seen on other occasions. The weather was wet that afternoon, and there was little wind.

Mr. CHANNELL: It had not been dried on the boilers, to your knowledge at all events?

Witness: No; certainly not.

Did you direct dust to be taken out of the gutters and dried on the boiler?—Yes; so that I could see what it was composed of.

Why?—Because it was taken out of the gutter in a state of mud. There were bits of slate, feathers, and other rubbish. I said: "Dry it, and let us see what is in it."

The object was not to see what was in the gutter?—No.

What were the boxes kept for?—As evidence of what was taken out of the gutter, pure and simple, and for no other purpose.

If it was to show what was in the gutter pure and simple, you did not want this preparation?—I took the dust to see what it was composed of. The painters removed it from the gutters; and I told Adams to dry it, sift it, and keep it in boxes. We began painting on Oct. 26 last; and it was taken out of the gutters after that time by the painters. I gave no further directions as to the dust or the boxes. I saw the boxes—two of them full and one partly full; and I said it was not necessary to collect any more. I did not see them again until Dec. 10, when Mr. West came to the works. From the early part of November until that date, the boxes were kept in the loft.

Why were they kept there?—It was not with any purpose. It was a convenient place. Adams said the sifted dust was in the drying loft.

Where your leather and polishing tables are?—Yes. When Mr. West came I informed him of these boxes, and asked Adams to tell me where they were. He said they were close to the rolling-table; and I found them there—two boxes. There was a third box covered over. That I have recollected since I was here last. To the best of my belief, two boxes were nailed down, but not firmly. The third box was open.

Who found the third box?—My son fetched it. I sent him to Adams to ask where it was. There were no more than three boxes in the loft. There were four in the office altogether.

It is untrue that Mr. West found the boxes under a piece of sacking?—Certainly. He may have seen the same boxes under the cloth, if he looked at the place, if you call that finding.

Is it true that, upon your mentioning that you had collected some dust out of the gutters, Mr. West asked to see it?—No; I brought the boxes voluntarily to Mr. West.

Is it true that you directed your man to try to find them, and that he searched for them?—It is absolutely untrue.

Did Mr. West find any boxes himself?—No; it is not true.

Did you tell Mr. West that the dust had been sifted?—I do not know. I was perfectly open and candid in the matter; and I should think the probability is that I did explain it.

Did Mr. West and the others thereupon say: "Let us have it sealed up"?—Excuse me, they said nothing of the sort. I suggested that the boxes should be sealed up.

Why?—I thought the dust should be kept.

Am I to understand that it struck even you that having the boxes found in that place was a suspicious thing?—No. After Mr. West had taken a sample of it, I said: "These boxes must be sealed and kept in the office."

It did not strike you in any way as odd that open boxes should be where they were?—No; it was the most natural thing possible. I had given Adams instructions to collect it.

I take it for granted that you did not instruct him to sprinkle it over the leather?—Certainly not.

And you think it natural it should be in the loft, where you were complaining of the existence of similar stuff?—Yes. No idea of a dishonest purpose occurred to me until it was mentioned in Court.

But when samples of leather were taken from the tannery in connection with the first claim against the Company, did not the witnesses tell you that they did not believe all the marks came on it naturally?—Yes. Mr. Newbigging said: "I never will believe that that stuff came from the gas-works."

Were not the blotches so large as to make it difficult to believe that they came from the gas-works?—No; I had seen dozens like them.

Did not Mr. Newbigging say that, in his opinion, these dirt marks had never been deposited in a natural way?—No; his words were: "I never will believe that that dust has been blown in in that way from the gas-works."

Did he express the opinion that they were so large that they could not have come in upon the wind?—No.

Did he express great surprise at the extent of the damage?—The marks were far more serious than he expected to find.

Did he not say that these dirt marks had never been deposited in a natural way?—He expressed that as his opinion.

Will you attend to the question? You have answered it very positively both ways in the last few minutes. Did he tell you they had never been deposited in that way?—No; he answered as I have told you.

That it must have been wilfully put there?—No; he never made such a suggestion.

And did not you say: "There is no man in my employ who would dare to do it"?—He said something indicating suspicion, and I repudiated it; but I do not remember the words.

You understood him as meaning that these large blotches could not have come there naturally, and must have been put there somehow?—I regarded that as his opinion, and I repudiated it; but I cannot remember the words.

Did you not think that these blotches were so large as to require some accounting for?—Certainly not. I have seen it a dozen times myself.

Did you not think they were so large, in fact, as to make suspicion rather natural?—No; I did not.

Do you remember giving evidence before Mr. Ridley on the former occasion?—Yes; but I do not think I gave evidence to account for the largeness of the blotches. I never had the slightest doubt as to the way in which the dirt came from the gas-works. The leather is hung close to the louvres; and the dust naturally pitches upon them when it comes

* See "JOURNAL," Vol. XLV., p. 445. † *Ibid.*, Vol. XLV., pp. 586, 633.
‡ See "JOURNAL," Vol. LXIX., p. 1141.

through. I never saw any patches as large as the palm of the hand. The size would be nearer that of a threepenny piece.

In further cross-examination, witness said: In the first action, a large part of the complaint was of the particles of coke dust from the coke-yard. In calm weather, it is now a little better, owing to the covering of the yard; but the chief part of the dirt comes from the retort-house. Dust accumulates in calm weather about the roof of the coke-shed; and in rough weather it is blown through the cracks and crevices of the roof. I do not believe that the roof is dust-proof. It is not boarded inside. The smallest part of my complaint is of the dust that comes through the roof. Smoke and coal and coke dust come from the retort-house. Sooty particles are far more serious than coke. A lot of very fine grit and coke and coal dust also comes in. All these things damage the tan liquor; but the soot most, I think. I never alleged that the most serious thing was that the coke from the coke-yard got into the tan liquor and brought iron with it. I have always been of opinion that the soot was the more serious nuisance. The trouble began with the erection of the new retort-house. While it was being built, a large quantity of dust came in; and I complained of it to the Gas Manager. This was not serious enough to make any great complaint of. At the time (February, 1894), I was complaining of the Company's ammonia works. When the new retort-house was started, the nuisance was very great. It is not now so bad as that. The chimney of my works has not been swept. It was examined last Easter, and there was nothing to sweep away. It occurred to me then that the chimney ought to be examined, because of an insinuation in the affidavits of one of the defendants' witnesses respecting the chimney of my works. On April 27 last, I wrote in my diary that there was a large opening at the south-east corner of the roof of the retort-house, from which smoke was escaping very freely. That was a mistake. What I thought was an opening was a tank. I have an entry in my diary, under date Sept. 25, of the escape of dense smoke from the roof of the retort-house, in which I remark on certain openings. I made no entry of the direction of the wind on that day, and do not remember that there was a very severe northerly gale which blew off slates from the retort-house.

Mr. Channell: If there was a strong northerly wind, the dust could not have been blown from those openings on to your works?

Witness: It seems scarcely probable; but the wind works round. Witness went on to say that in November the blacks were very bad. The meteorological records might show that the wind was then north and north-east; but blacks fell whenever it was high, whatever might be the direction. Owing to the prevalence of blacks, they ceased to put hides into the lime-pits last September; and in November they discontinued putting the glue-pieces through the process to which they were subjected. The glue-shed had not been swept since.

If blacks and soot came in while you were working, is there any reason why they should not come in now?—They do; but the screen and roof of the coke-shed keep them out. I do not now take an interest in the place; and it does not matter if there are 6 inches of dirt there. The suspender pits have been pumped out recently, and are not used. If the dirt does not come in now to the same extent as before, it must be remembered that it is summer.

Have you noticed the extraordinary fact that when you can see smuts on the liquor, you cannot see them on the treads?—No; it is an absurd theory.

Then have you noticed the contrary?—Yes; often.

Have you cleared them up to prevent them getting into the pits?—No; you cannot do it. It is like picking up particles of dust in the road; and I should not know how to do it. Besides, the treads are constantly being washed down with the liquor from one pit to another.

In further cross-examination with regard to tanning materials, witness said that he used in 1895 per hide 49 lbs. 4 oz. of valeria, 34 lbs. 8 oz. of myrobalans, 4 lbs. 6 oz. of oakwood extract, and 6 lbs. 7 oz. of mimosa. One of the difficulties of the business, especially in the making of thick leather, was that the process took so long that the prices meanwhile varied very considerably both of the raw material and of the finished product. In 1895, there was a "boom" in the trade, and figures were high; but since then trade had been quiet, and prices moderate.

Mr. Channell: On the last occasion, you said your prices had not diminished; and you could not show us any instance in which you received less through the bad leather?

Witness: I do not remember saying that. I said the leather was damaged, but not unsaleable.

And you could not say you had sold any leather at less prices in consequence of the damage?—I do not recollect saying anything of the kind before.

Can you say it now?—Yes. Since the last inquiry, my general prices are lower, not only through the dulness of trade, but also through diminished quality.

Is it correct that down to the last inquiry you had not suffered loss; you had sold all the best goods, and kept back the rest?—I said I was fortunately favoured by the boom of 1895, which enabled me to pass off on a rising market a lot of leather which otherwise I might not have been able to sell.

Do you say you have suffered in the prices of what you have sold?—Yes; I sold best quality for second, and so on. Messrs. Vicary and Sons, tanners, of Newton Abbot, and I are competitors in trade.

Is it a fact that you never got prices equal to Vicary's until our retort-house was opened, when you got more?—No; it is utter nonsense.

Well, I have the prices since 1889; and I suggest that the comparison shows that, until our new retort-house was opened, you were never able to get prices equal to theirs?—It is not true.

Mr. M'Call: Vicary's prices may have come down.

Mr. Channell: Prices vary according to the market.

Witness: I think, speaking generally, my prices for No. 1 quality of leather averaged lower than theirs from 1889 to 1896.

Can you show me any instance in which you failed to get what other people were getting?—I feel sure the damage has affected me.

The Official Referee: You have to give me some evidence on which I can form a conclusion. Your "feeling sure" will not help me.

Mr. Channell: In 1889, your price for No. 1 quality of leather was 2d. per pound less than Vicary's; in 1891, it was ½d. less; and in 1893, 1½d. less. Then in 1895 you started at 2½d. less, and in June you got to the same price; while one month you were 1d. higher?

Witness: I have no means of saying. It is not to my advantage to have the work partly stopped, even though business is dull. Witness went on to deny that he had said he was anxious to get rid of the business and retire from it. It was not true that his son did not like it, and had refused to go on with it. A few years ago, a gentleman had some negotiations with him with a view to a partnership; but not to take over the business entirely.

For the damage done since April, 1896, you claim £4289?—Yes. In the former action, I received £3200 to cover damages for all goods then on the premises and all liquor in the tan-pits.

Every hide which you have since put into the pits has gone through some portion of that liquor?—I suppose it has. All the butts put into the pits since April, 1896, are still there. I have not attempted to assess the damage myself; I have left it to the experts. But I am of opinion that the goods on my premises are more damaged than before.

Is that in consequence of a greater number of blacks rolled in?—I have not taken any leather out of the pits, and the blacks cannot be rolled in; and for all the leather you have seen, my damages have been paid.

So that the experts have estimated what will be the damages when the butts are taken out of the pits?—Yes; and the damage to the liquor.

These damages are not in diminished receipts, but mainly in stock unrealized?—The damage to the goods in the pits is prospective. The claim for loss of business is, of course, an estimate. I bought, twenty years ago, the land on which my pits stand, and transferred part of the plot to the Gas Company. It is on this plot that they have built the new retort-house.

Wednesday, June 30.

On the resumption of the proceedings this morning,

Plaintiff was re-called, and further cross-examined by Mr. Channell. He said that if one butt was kept at the top of the pit while undergoing the process of tanning, he should commend the foreman for prudence in doing it to protect the others. It was not true that he produced these butts to the experts and to the witnesses representing the Gas Company without explaining that they had been so exposed. There was no rule in the matter. He had tried experiments of the kind, to see if dust did really settle on the leather in the pits; but this was only temporary. As to the work of the witness Adams on Sundays, it was customary in all tanneries for a man to go in on Sundays. It was necessary to do it. Adams had done this for many years. He had not been there on Sundays since the adjournment in May. During that time his premises had been under police supervision from one o'clock on Saturdays until six o'clock on Monday morning. The police had locked and sealed up the place, and no one in his employ had been there.

Re-examined by Mr. M'Call: He had carried on business in Plymouth for 32 years. Until the lad M'Farlane went to Mr. Bellamy's office, no suggestion was made that he had been guilty of any dishonesty in connection with this case. Mr. Newbigging had made some suggestion when he visited the works in connection with the last case; but after that the Company offered and paid him £3200 in settlement of his claim at the time. All the works and the railway in the vicinity of his tannery existed before September, 1894, as they do now; and Mr. G. Henderson, the Chairman of the Company, in his evidence in the last case, said he did not suggest that he (plaintiff) suffered any substantial nuisance from these works. He used very little coal in connection with the boiler of his works. The fuel employed was coke and spent tan. He had discontinued the use of tan as fuel. With regard to the dust collected from the gutters, he did not personally know where it was sifted. He saw the boxes containing it in the drying-loft. There was always a large quantity of sacking about, to cover the leather in process. He had no recollection of seeing it covering the boxes. He ceased to put fresh hides into the tan liquor in September last, because he saw that they must be injured. It was not because he had any idea of retiring from or selling the business. He did not think it would be possible for the witness Jones to have seen Adams sprinkling dust on the tan-pits, even if anything of the sort had taken place. The distance was too great for anything of the kind to have been seen. It was not true that the nuisance was abated. The test-papers exposed in the tannery showed a continuance of dust and smuts from September last. The hides which were kept on the top of the pits during the fortnight in which he was experimenting, were found to have particles of dust upon them. They were not kept after the experiment.

Mr. *E. Ellis*, examined by Mr. Graham, said he was a Justice of the Peace and a member of the County Council of Surrey, and had carried on business as a tanner at Bermondsey and Shalford for forty years. He visited the plaintiff's works on July 16, 1895, and at subsequent dates. On the occasion of his first visit, the screen between the coke-shed and the tannery had not been put up. He found the floor of the glue-shed covered with fine black dust; and small black spots were on the glue pieces drying in the shed. The louvre boards were also covered with it. The leather-drying sheds were in a filthy state; and dust covered everything, in spite of the precautions taken to exclude it. Cleanliness was of the first importance in a tannery. Buyers took immediate advantage if the leather was soiled, though intrinsically it was no worse. He was surprised to find how far the dust had penetrated into the loft. He did not believe that the result could be produced by a man sprinkling dust about. It was such a result as could be produced by dust from gas-works carried on as the defendants' works were. He found a similar state of affairs in the tan-yard, though the dust was not so apparent there as in the loft. The damage done was more serious there than in other parts of the works. The liquor could be discoloured, and injurious effects be produced, by smuts and dirt, as well as by iron particles. He noticed that the liquor was discoloured, that accumulations of particles were on the top hide, and the hides generally were darkened. He took samples of liquor from two of the pits, and found that when t settled there was a dark sediment, which accounted for the discoloration of the leather. It would injure a tanner's reputation to send out discoloured leather; and it would not be prudent for him to continue working under such circumstances. His (witness's) advice to plaintiff was to decrease his business. At that time he saw flakes of soot falling, and a man stood near and swept them off. On Nov. 16, 1895, when he visited the works again, the conditions were the same. A butt was placed at his request about 25 feet from the louvre boards; and in the course of ten minutes several patches of soot fell upon it. He saw leather in stock which was

discoloured. The ground colour was spoiled by the dark liquor in the pits, and there were also patches of smuts and soot which had fallen on the leather in the drying-sheds, and been accidentally or otherwise rolled in. The two effects were distinct. On April 23, 1896, he accompanied the then Official Referee, Mr. Ridley (now Mr. Justice Ridley) round the tannery, and found the conditions much the same. He paid another visit to the tannery on April 23 last. At that time, the coke-yard was roofed, and the Dulier process of ventilation had been adopted in the retort-house. He expected to find a great improvement as the result of these works; but the conditions in the tan-yard and the sheds were as bad as ever. He had a test sheet exposed while he was in the loft; and in 45 minutes a number of blacks and smuts were collected which would, in his opinion, render it impossible for a man to carry on the business of a tanner. It was a day on which there was a small make of gas; and there was a little wind from the south-east. He made a careful examination of the liquor in the pits, which was then worse than on former occasions—very much darker. He selected a hide, from which a sample was cut. It was dark in colour; and the presence of iron or some dark material was indicated in the appearance of the texture of the leather. It could not be sold as first-class leather, nor could this quality of leather be produced from such liquor as he saw in the pits. The cause of the discoloration of the leather was the smuts and grit from the gas-works. He saw bellies which had been tanned since the conclusion of the former action; and they were utterly unsaleable through discoloration. The colour was darker, and the texture of the leather blacker, than it was last year, though it was then far from satisfactory. On all his visits, he found the greatest precautions were being taken by the plaintiff to minimize the mischief. He (witness) paid a visit to the tannery on the previous day, and was surprised at the large amount of dust there. In Bermondsey, they experienced no injurious effect from the presence of a railway. It was necessary for a man to visit the drying-sheds on Sundays; and, so far as he knew, it was the universal practice for a man to do it. He had had a large experience as a valuer of tanneries and an adviser of tanners. Plaintiff followed the ordinary processes.

In cross-examination by Mr. Channell, witness said his suggestion was that the flakes of soot blew through the louvres from the gas-works into the drying-loft, and did not fall from the roof. They were extremely light, and about the size of the tip of the little finger. There were patches which it was rather difficult to account for as having been blown in. His explanation was that, where there were large patches of similar size and shape on one piece of leather, the first was pressed and spread by the roller, and the revolution of the roller repeated it on another place. His ground for saying that the nuisance was as great in April last as on the occasion of his former visits was that dust and smuts still came in, and the liquor in the pits was discoloured. His explanation was that the smuts and dust collected on the roof of the coke-shed, and came in with the wind whenever it blew from that direction. The most natural way of accounting for the darker appearance of the texture of the leather was the presence of more iron or other dark substance in the liquor. He did not agree with Mr. Procter, who was called at the last hearing, that these appearances were due solely to iron.

By Mr. M'Call: He was not in sight of the test-paper all the time; but, to the best of his recollection, Adams accompanied him on his inspection. The test-paper was such as he would expect from the general condition of the tannery. His impression, which was borne out by the test-paper, was that there was increase of grit and decrease of smuts.

Mr. *T. C. Reed*, Managing Partner of the firm of Messrs. Pethybridge, Reed, and Co., tanners, of Launceston, was then examined by Mr. M'Call. His affidavit, which was taken as his evidence-in-chief, said he visited the plaintiff's tannery in November and December, 1895, and January, 1896, and found it in a very dirty condition, due, in his opinion, to the large quantity of smuts and black dust from the new retort-house. He went again on Oct. 26 last, and found the conditions in no way improved. The roof over the coke-yard acted as a reservoir for the dust and soot; and when the wind blew, the stuff was carried into the tannery. There was nothing to indicate that the alterations effected by the Company had in any way caused an abatement of the nuisance. On one of his visits, with the wind north-north-east, he had a butt placed on the floor, and stood by it for 15 minutes, during which time it was sprinkled over with fine dust, which he thought came from the gas-works. It was a common practice in tanneries to burn spent tan; but this would not produce such dust as he found. On the pits he noticed threads of dust, which seemed to be cobwebs weighted with dust which had fallen from the roof. He did not see any place except the gas-works from which the dust could come. There were dense clouds of smoke from the retort-house, and none from the chimney of the tannery. In April last, when he visited the tannery, he found gravel-like lumps of hard soot on the rolling-tables. Under the conditions which he witnessed, it was not possible to carry on the tannery successfully. He saw nothing to induce him to believe that the soot, smuts, and grit had been put there fraudulently—in fact, he believed it was impossible to do it.

By Mr. Channell: His opinion was that things had become worse rather than better, in spite of the alterations carried out. His theory was that soot and dust were deposited on the inside of the roof of the coke-shed, and were blown out through the interstices whenever a gale occurred.

The Official Referee suggested that the polishing-tables should be swept down on some afternoon, and the room locked up for 12 or 18 hours; that the tables should then be swept again in the presence of representatives of both sides, and the deposit brought into Court for examination.

Counsel promised that this should be done.

Thursday, July 1.

On the resumption of the inquiry this morning,

Mr. *Reed* was recalled, and was further cross-examined by Mr. Channell. He said tanning liquors became cloudy as they were in use, but they did not grow darker with length of time.

Re-examined by Mr. M'Call: He did not see anything to suggest that the dust came from any other place than the gas-works. It was the usual practice at tanneries for a man to go in on Sundays. In some stages, this was absolutely necessary.

Mr. *T. Gray*, examined by Mr. Graham, said he carried on business as a painter in Plymouth, and had on several occasions painted the woodwork of the plaintiff's tannery. He commenced to paint on Oct. 26, 1896, and finished on Jan. 5 last. It was painted with two coats of white lead paint in stone colour. Before beginning the work, he cleared out the shutes (gutters), which were nearly full of smuts. He had never seen them like it before, and had not seen any shutes so filled in other parts of the town. The stuff was gritty, and he called the plaintiff's attention to it, because he could not get on so fast as he wished. As the men were painting, gritty blacks fell and worked up with the paint, and altered the colour. This was particularly the case on the flat surfaces. It affected the brushes, and wore them out. The painters' clothes were covered with smuts, as if they had been splashed with black paint. He told the plaintiff he could not be responsible for the colour of the paint on the job. Smoke and dust poured out from the coke-shed, particularly at the western end; and it filled the air like a lot of little flies dancing about. The louvres were buried in smuts; and the gutters had to be cleared out again before the men could put on the second coat of paint, at an interval of three weeks or a month. At the northerly end of the tannery, farthest from the gas-works, there was nothing but the ordinary dust. He had not found anything like it when painting the tannery on former occasions. The work took longer than it ought to have done.

Cross-examined by Mr. Channell: Mr. Ward insisted on the first coat of paint being finished all over the job before he began to apply the second coat; and this delayed him. The gutter opposite the retort-house was full of dirt, while that next to the railway was not; and there was a difference in the character of the stuff in the two places. He had on many occasions seen smoke come out of the coke-shed whizzing like a lot of flies. White lead paint was affected by sulphur in the atmosphere. It might be true that white lead was not the best foundation for paint for some kinds of work, though it was best for others. The paint on the side nearest the gas-works was not in so good a condition now as that on the other side. Ordinary smuts would blow away; but the dirt in this place would not.

The Official Referee: If that is true, ordinary house fronts would never get dirty.

Witness: Well, I do not mean that smuts never stick.

Charles Henry Vinson, examined by Mr. Graham, said he worked for the last witness, and helped to paint the plaintiff's premises. He cleared out the whole of the gutters from the south end of the building round by the west to the north side. The gutters were full of dark material like charcoal, with hard gritty pieces like pumice-stone. Near the railway, the character of the stuff was different, and its colour lighter. He collected the stuff in a bucket, and put it into a tub provided by one of the plaintiff's workmen. When painting, the paint turned from stone colour to slate colour owing to the blacks. Many times he felt tempted to leave work because of the smoke and smuts from the gas-works chimney. It filled the air like a lot of flies or beetles, and sometimes like a flight of birds. It made him black; and when he left work people asked him if he was employed at the gas-works, as they thought he was a stoker. His wife grumbled at the washing; and, in order to avoid this, he put his clothes in a bucket of water to soak from Saturday to Monday before taking them home. He found the other side of the tannery, away from the gas-works, much more pleasant. The boy M'Farlane told him to save all the stuff out of the gutters.

Mr. *J. Taylor*, a leather merchant of Plymouth, was examined by Mr. M'Call. He had made an affidavit as to visits to the plaintiff's tannery on Oct. 30 and Nov. 5 last. On each occasion, he found a thick deposit of dust on the leather and in the lime and tan pits. It was worse on the second than on the first occasion. The new paint on the louvres was covered with smuts of black dust, which were to be found all over the place. Under existing circumstances, it was impossible for the plaintiff to turn out leather of clean and bright appearance. All the leather in the place was discoloured. Plaintiff was still suffering, and under existing conditions would continue to suffer, very considerable pecuniary damage in consequence of the nuisance from the new retort-house. Before the house was built, the plaintiff had a reputation as a tanner of bright and clean leather.

Mr. M'Call: It is suggested that the dirt in the tannery comes from the railway?

Witness: I think the suggestion is absurd. My own workshop adjoins the Great Western main line, and trains run close to my louvre boards, and engines often stop near. There must be ten times the number of trains on that line that there are on the branch line near the plaintiff's tannery. I manufacture very fine leather, and have never found from the railway any such effects as I saw at the plaintiff's tannery. In the course of manufacture my leather is damped and oiled, and is exposed to the open air through the louvres and windows.

So that if smuts, dust, or grit came from the engines, the leather in that condition is likely to catch it?—Yes; and it would be seriously stained and damaged. I could not produce the leather I require if I had to remove my works to plaintiff's premises.

Is it possible for the condition of things you saw to have been produced by sprinkling dust about?—The condition of things existing could not be explained in any such way; and there is nothing in the locality to account for it except the gas-works. I have had dealings with Mr. Ward; but my customers commenced to complain of his leather in 1895, and we gradually reduced our dealings with him, and have had nothing from him for some time.

In further examination, witness described the result of another visit he paid to the tannery on April 22 last, when the effects observed were the same as on the previous occasions. He did not think it possible for the two businesses of tanning and gas making to be carried on so close together as the works of the parties in this case.

Cross-examined: No idea of fraud entered his head. He had returned goods to Mr. Ward which were unsaleable because they were damaged. After the last action, Mr. Ward offered him some of his stock at a reduction of 1½d. or 2d. per pound; and he took a portion of it. But he had so many complaints respecting it that he did not take any more.

Joseph Warne, an ex-inspector of the Plymouth police force, examined by Mr. Graham, said he was instructed by the plaintiff on May 15 to take charge of the place. His custom was to lock and seal the doors of the loft in the evening, and to reopen them in the morning. At 1 p.m. on May 15, he swept down the two tables used for testing purposes, and laid down near them test-papers. At 6 a.m. on the

17th he found the papers practically clean, and a little dust on each of the tables. The wind varied from south-east to north-east during that time. At 11.15 a.m. on the same day, the plaintiff's son sent for him to the works, and said that blacks were coming in. He saw a few. He did not go again until the 25th, when he put down more papers. They remained from 10.30 p.m. until 6 a.m. on the 26th, when he found them clean. At 7.15 a.m., Adams asked him to go down again. He reached the tannery at 8.15, put down more papers, and left them there until 6 a.m. next day. These also were slightly marked, but more than the first; and there was a little dust on one of the tables. The wind was south with rain at first, fell calm, and in the morning was north-east. Witness went on to give particulars of other observations; some showing like results, and others more blacks. On the 2nd of June, he saw a lot of dirt fall on to the test-papers which he had laid down; and the quantity which accumulated, both on the papers and the tables, was larger than on the former occasions. There was a strong south-easterly wind at the time.

The Official Referee remarked that the packets of dust collected from the tables on that occasion did not contain anything so large or so hard as that on the test-papers.

Witness said that another day when blacks came in very thickly was the 8th of June. On that day, he put down papers which remained exposed from 9 a.m. till 2 p.m. These were more thickly covered than the others. The wind was south-east, strong.

The Official Referee said he had there a lot of stuff which looked like road grit; while another specimen was more like quartz or flint than coal.

Witness gave similar evidence as to other dates, and said that on the 23rd of June the plaintiff called his attention to smoke coming into the tan-yard, and to the fact that light dust collected on one of the butts which was left uncovered so that the experiment might be made.

Mr. *J. A. Bellamy*, the Deputy-Chairman of the Gas Company, produced at this stage packets of dust taken, at the suggestion of the Official Referee, from the tables in the rolling-loft of the tannery, which had been locked up from the previous evening until noon. He said that the wind on Wednesday evening was very light from the north, and that day it was very light from the north-west. Witness also produced several louvre boards which had been taken from different sides of the buildings.

Friday, July 2.

When the Court resumed this morning,

Dr. *Robert Hellon*, F.I.C., Public Analyst for the counties of Cumberland and Westmoreland, examined by Mr. Graham, put in the joint report of himself and Mr. F. Tate on certain samples of dust, and the test papers produced by the witness Warne on Thursday. A sample taken from the bottom of one of the empty tan-pits on June 28, in the presence of the Official Referee, consisted almost entirely of tanning material, hair, feathers, and ordinary tannery dust, a very small proportion of coke particles (doubtful), a few coal particles, and a very small proportion of blackened vegetable fibre. The dust collected by Warne from one of the tables on June 8 was chiefly black dust, consisting of some coal and coke dust, with some vegetable charcoal, considerable quantities of lime (in large particles), hair, mica-like particles, plaster, brick dust, and general dust, with a large particle of pale green transparent resin. On the test papers produced by Warne were: (1) Particles of grey dust, chiefly shell-like lime plaster; (2) mixed dust, mainly consisting of black particles, mostly coke, considerable quantities of crystalline sandy particles, some lime, and ordinary dust containing iron; (3) a large amount of sandy matter, some blackened by contact with dirt, several pieces of lime, some animal and vegetable fibres, some coke and coaly matter, and some general dirt, including wheat or grass husks; (4) slate, plaster, lime, sand, coke, vegetable charcoal, and finely-divided carbonaceous matter bound together, but of what exact origin was difficult to determine. A large separate particle, particularly noticed by the Official Referee, was quartz blackened on the surface. Witness went on to say that on March 17 last, he received two samples of tan-liquor taken from plantiff's pits in June and December, 1896, and also samples of dust taken from the tables this year. In the tan liquor of June, he found 14·1 per cent. of solid matter, and 1·2 per cent. of ash; the latter containing 0·0016 per cent. of iron. The sample of December gave 14·6 per cent. of solids, and 1·3 per cent. of ash; the latter showing 0·0020 per cent. of iron. Dust collected in March, when the tannery furnace fires were out, gave 49·3 per cent. of carbonaceous matter, and 50·7 per cent. of ash. The ash gave 36·1 per cent. of silicious matter, and 6 per cent. of iron. On microscopical examination, he found the following percentages: Coal and coke, 55·5; vegetable charcoal, 2·5; fibre, 7; white mineral particles, 26; coloured mineral particles, 9. In two other samples taken from the floor of the glue-shed, there was 6·1 per cent. and 7·5 per cent. of iron; and, on microscopical examination, 39 per cent. and 28 per cent. of coal and coke. He analyzed samples of dust collected from the rain-gutters of the tannery in November and December last. He found that it consisted of 46·9 per cent. of carbonaceous matter, and 53·1 per cent. of ash. The ash gave 37·4 per cent. of silicious matter, and 8 per cent. of iron. The microscopical examination showed the following percentages: Coal and coke, 58; vegetable charcoal, 4; fibre, 18; white mineral particles, 9; and coloured mineral particles, 11.

The Official Referee asked whether the last sample was from the boxes of sifted dust as to which evidence had been given.

Plaintiff said it was. He opened one of the boxes, took a sample, and sent it to Dr. Hellon; immediately resealing the box.

The Official Referee: You broke the seal? That was an error of judgment. The idea of sealing was to keep the boxes intact, and bring them into Court.

Witness (continuing) said that he considered the proportion of vegetable matter in the samples very small for a tan-yard. The presence of 20 parts of iron per 1,000,000 in the liquor was dangerous. From 2 to 4 parts per 1,000,000 of iron in tanning liquor would produce a perceptible discolouration of the leather. The dust of a tannery was usually brown; but in this case it was black. The striking part of his examination was the huge preponderance of coal particles, and the extremely small proportion of vegetable particles. He never saw so large a proportion of coal and coke dust in a tannery. The results of his chemical analyses were practically identical with those of Mr. Tate and Mr. G. E. Davis, who had made similar analyses for the defendants. He found, in one sample of leather taken from the plaintiff's tannery, 290 parts of iron per 1,000,000; and in another sample, 460 parts per 1,000,000. In a good average sample of leather from a tannery at Liverpool, the proportion of iron was only 110 parts per 1,000,000. Dust taken by himself from the louvre boards nearest to the gas-works, contained a less proportion of iron than other dust which he analyzed. This, he thought, was due to the fact that the larger particles of coal and coke dust would roll off the sloping louvre boards.

By Mr. Channell: So far as they had done common work, he and the chemical witnesses on the defendants' side were in substantial agreement. He found that the proportion of iron in the tanning liquor tended to increase. This would be a natural result if the liquor was in contact with anything containing iron—the solution of the iron would be continuous. The substantial differences between the samples of dust analyzed was that there was a larger proportion of lime in that taken from the glue-shed, and a less proportion of iron in the dust which he took himself from the louvre boards. Iron was found in almost everything; it was in the stone used for road mending. This would be insoluble iron, which he distinguished in his analyses. His view was that the chief portion of the soluble iron in plaintiff's liquor came from the coal.

By Mr. Graham: The louvre boards brought into Court by direction of the Official Referee were covered with soot.

By Mr. Channell: The loss of colour of the paint was probably due to sulphide of lead.

The Official Referee suggested that Dr. Hellon and Mr. Tate should take the samples of dust produced by the witness Warne, separating those taken during the prevalence of a southerly wind from those in a north wind, and make an examination and analysis of them. He also wished them to examine the samples produced by Mr. Reed and by Mr. Taylor, as well as those taken at his own suggestion by Mr. Bellamy and Mr. Reed; and to compare them with samples from the boxes of sifted dust in plaintiff's possession.

L. J. R. Glanville, examined by Mr. Graham, said he had been in plaintiff's employ for eight years. M'Farlane frequently called his attention to the fact that smuts were falling in the works. He did not believe it was possible for Jones to have seen Adams throwing dust on the tan-pits, even if such a thing had happened. The place where it was said to have occurred was dark, especially at such an early hour as 8 o'clock on a winter's morning. He had never seen anything of the sort done, and had no reason to believe it was done. There was no nuisance from smuts and dust before the new retort-house was open; but since then he had frequently seen them falling. They came through the louvre boards on the south side of the tannery. The nuisance was greater in winter than in summer. He had seen the place so full of smoke, that it was almost impossible to see from one end of the loft to the other. This state of things had occurred a dozen times since last October. The nuisance was less now in calm weather than before October, but it was as bad as ever in rough weather.

Cross-examined by Mr. Channell: Except for the difference between summer and winter, he saw no variation between the extent of the nuisance before the alterations at the gas-works and now. It was on June 11 that he saw smoke pouring into the loft, and noticed that they could not see distinctly from one end of the loft to the other.

The Official Referee: That was the day on which Warne said he found the papers practically clean.

Mr. Channell: Yes; and on the day before, and the day after.

Witness: Warne was not there at that time. I cannot say whether there were any papers exposed then.

The Official Referee: This is becoming interesting.

Mr. Channell: I do not wish to push it too far. Warne's papers were not exposed at that time. But he found them clean during the night; and his evidence was that he was sent for when there was anything special to note, and he was not sent for at this time.

Witness, further cross-examined, said that his note showed that on June 11, 12, and 14, the smoke was as bad as ever. He did not believe that dust could be seen on the tan-liquor on a winter's morning, as Jones said he saw it.

Mr. Channell: Adams distinctly said that he looked at the liquor, and saw the dust floating on it at the time. That is recorded in his notes made at the moment.

Charles Bickle, examined by Mr. Graham, stated that he had been in the plaintiff's employ for 25 years, and for some time had been leading hand in the tan-yard. Before the new retort-house began to work, there was no trouble through smoke or dust. Afterwards there was. Speaking generally, he did not see any improvement since the Gas Company had carried out the recent alterations. He did not think it was possible for Jones to have seen Adams putting dust on the pits, if anything of the kind was done. It was the custom of Adams to leave before the rest of them at breakfast time, and to pass through the tan-yard in going out. He never saw Adams put anything on the butts or pits.

Mr. Channell: It was true that, during one fortnight in January, 1896, one butt was kept at the top of the pit during the tanning process, and no tanning material was put on it. This was by Mr. Ward's order. It was not done at any other time. The object was to collect the dust on the butt, and keep it off the others. He could not give any explanation as to how this object could be attained by leaving the tanning material off the butt.

W. J. Soper, in examination by Mr. Graham, said he had worked for plaintiff for 20 years. On December 11, Adams asked him for a box; and he made one to hold the dust which had previously been collected. He saw the two boxes of dust then for the first time; and the dust from the two was put into the one box he made. He had not seen dust come into the works, but had noticed it on a butt in the place.

The Official Referee remarked that there seemed to be a curious discrepancy in the evidence respecting these boxes.

Mr. Channell said the first explanation as to the boxes was given by Adams; and every witness called by the other side seemed to be for the purpose of contradicting Adams.

The Official Referee: That seems to be the effect of it.

Mr. Graham said the explanation of what occurred was that, on Dec. 10, Mr. West and Mr. Davis visited the tannery. Two of the boxes were then

produced; and young Mr. Ward was sent to ask Adams where the third was. Then they came on the next day, and wanted to have samples. In the meantime, the contents of two of the boxes had been put into another and stronger box, so that the three boxes had in consequence become two boxes.

The OFFICIAL REFEREE: That may be all correct. But the evidence is that, after the boxes were shown to these gentlemen, they were taken into Mr. Ward's office, and in their presence were sealed up.

Mr. GRAHAM understood that this happened on the second day—Dec. 11.

The OFFICIAL REFEREE: Well, that is not the evidence.

W. H. Curtis, in answer to Mr. GRAHAM, said he worked for plaintiff until recently, and had seen smuts and dirt on the leather. There was no improvement after the alterations at the gas-works. He saw the boxes of dust in the rolling-loft, and perfectly well remembered them being carried down to Mr. Ward's office the day Mr. West and other gentlemen visited the tannery.

Saturday, July 3.

When the case was resumed this morning,

Dr. *Hellon* presented the joint report of himself and Mr. Tate on the various samples of dust submitted to their inspection by the Official Referee. The two boxes had been sealed by Messrs. Davis and Tate; but the seals had been broken. Samples from these boxes were compared with a sample of dust contained in a bottle which plaintiff said he had filled from the boxes. The character of the two were so alike as to be indistinguishable. It was coal and coke chiefly, with vegetable fibre, and crystalline and other mineral particles. They next took two packets of dust collected by the witness Warne. One of the packets consisted of eight samples collected on various days, from May 15 to June 28, when the wind was south and east. The weight of the samples varied from 15 to 5160 milligrammes. The 15 milligrammes was from an exposure of 41 hours; and the 5160 milligrammes, from one of 5 hours—the wind in the latter case being so strong. There were five samples taken with the wind north and west. The weights in these cases were from 170 milligrammes to 1760 milligrammes; the former being of a collection of 13 hours, and the latter of 41 hours. As to the general character of the samples, they found that, as compared with the dust in the boxes and bottles, there was considerably more of fibre, lime, and quartz particles; and the colour was much lighter. The small dust, after sieving, showed many black particles of coal and coke, similar to the samples from the boxes and bottles. This applied to the dust collected, whether the wind was south and east, or north and west. The only difference between the samples collected when the wind was south and east, and those taken when it was north and west, was that in a high wind the quantity was considerably greater, and contained a much larger proportion of road dust, lime, &c. In other words, the strength of the wind rather than the direction affected the quantity and character of the dust. They next took the samples collected by Mr. T. C. Reed. One of these was obtained from the rolling machine table, and was said to have collected in 18½ hours on March 17 and 18. The dust weighed 6020 milligrammes. The second sample was of dust which fell on one of the tables in the rolling loft in 23 hours, on April 22 and 23; and it weighed 10,330 milligrammes. These samples were much blacker in appearance than those taken by Warne; containing a great amount of fibre, but not so much general dust. The first sample had a considerable proportion of damp leather fibre. Then they came to the samples collected by Mr. Taylor. One was from a table in the rolling-loft, and fell in 19 hours on April 21 and 22. This weighed 5840 milligrammes; and it contained more lime and fibre, and was more irregular in general character than Mr. Reed's sample of the same date. There was a little more general dirt, but less than in Warne's samples. The second of Mr. Taylor's samples was taken from one of the polishing tables, where it fell in 6 hours on April 22. The weight was 4700 milligrammes; and the character was similar to Mr. Reed's sample. They then came to the samples taken, under the direction of the Official Referee, by Mr. J. R. Bellamy and Mr. Reed. In these cases, the samples were collected after about 18 hours' observation. The first was from No. 1 polishing-table. The weight was 130 milligrammes; and it contained a large amount of hair and other matter—chiefly leather fibre, tanning material, general road dust, a vegetable husk, and very few coal and coke particles. The sample from the other polishing-table weighed 140 milligrammes, and contained a large mass of hair; and the general character was similar to the first sample, though there was less leather fibre and tanning material, and a much larger proportion of fine coal and coke matters and road dust. The sample from one of the test-tables weighed 180 milligrammes. There was a much larger proportion of quartz and mineral matter than in the samples from the polishing-tables, a large proportion of vegetable fibres, a considerable quantity of fine coal and coke matter, and it was very similar to Warne's samples in general character. The remaining sample—taken from the other test-table—weighed 370 milligrammes. It consisted of a considerable quantity of hair, a large proportion of leather fibre and broken tanning material, fewer crystalline mineral particles, a considerable proportion of very fine coal and coky matters, and very little general dust.

Mr. GRAHAM: You found coal and coke dust in every sample?

Witness: In every sample.

Mr. *Tate:* Very small in some.

Mr. GRAHAM: Did you find a larger quantity in the stuff in the boxes than in the other samples?

Witness: As a general thing. In some of the samples, it was about the same quantity; in others, it was less. The samples collected by Warne were lighter in colour than the dust in the boxes. The lighter colour is due to sand and road material.

The OFFICIAL REFEREE: I suppose that the presence of more tanning material in some of the specimens was because they were taken from the rolling-tables on which the leather was prepared?

Witness: Yes; there is a sample which is mentioned as being damp, and we explained that by the fact that it came from the rolling-table.

Mr. GRAHAM: The colour varied with the strength of the wind?

Witness: I think that with a high wind we had a larger amount of light-coloured road metal.

Further evidence was then taken; and the Court adjourned until Monday (yesterday).

BOW COUNTY COURT.—Monday, June 28.

(*Before His Honour Judge* FRENCH, Q.C.)

Carpenter v. Commercial Gas Company—Prosecution under the Alkali Act.

To-day his Honour had before him a summons taken out by Mr. R. Forbes Carpenter, the Chief Inspector under the Alkali, &c., Works Regulation Acts, 1881 and 1892, against the Commercial Gas Company, under section 9 of the first-named Act, which requires that owners of works shall use the best practicable means to prevent the discharge of noxious gases into the atmosphere.

Mr. FERGUSON and Mr. COLEFAX appeared for the plaintiff; Mr. HUME WILLIAMS represented the defendants.

Mr. FERGUSON, in opening the case, said the action was brought under the provisions of the Alkali, &c., Works Regulation Acts, 1881 and 1892. Section 9 of the Act of 1881 provided as follows: "The owner of any works specified in the schedule to this Act shall use the best practicable means for preventing the discharge into the atmosphere of all noxious gases and of all offensive gases evolved in such works, or for rendering such gases harmless and inoffensive when discharged, subject to the qualification, in the case of sulphuric acid works, that no objection shall be taken under this section by an inspector to any discharge of gas by a chimney or flue on the basis of the amount of acid gas per cubic foot of air, smoke, or gases, where that amount does not exceed the amount limited by the last preceding section." By that section, it was provided that "every sulphuric acid works shall be carried on in such manner as to secure the condensation of the acid gases of sulphur and nitrogen evolved in the process of manufacture of sulphuric acid to such an extent that the total acidity of such gases in each cubic foot of air, smoke, or gases escaping into the chimney or into the atmosphere does not exceed what is equivalent to 4 grains of sulphuric anhydride." For failure to use such means, owners of works were liable to a fine of £20 for a first offence, and £50 for subsequent offences, with £5 per day during continuance. By section 22 the fines were recoverable in the County Court. Provision was also made in the Act that proceedings should not be commenced without the authority of the Local Government Board. This had been given under the seal of the Department, and signed by the President. The prescribed 21-days' notice had also been served on the owners, stating the facts on which the Inspector founded his opinion as to the means which the manufacturers had failed to use. The offence charged against the Commercial Gas Company was twofold—first, that they had not used the "best practicable means" of preventing the escape of noxious gases; and, secondly, that they had allowed such gases to escape into the air. To show how the case arose, a slight outline of the course of manufacture must be given. In the distillation of coal for the manufacture of gas, certain impurities of a tarry and watery nature were given off, forming what was called gas liquor—an evil-smelling stuff containing large quantities of ammonia and other substances. This liquor was used in the manufacture of ammoniacal compounds, obtained by the distillation of the crude liquor. After the free ammonia had been distilled off, the residue was treated with caustic lime in boilers, and a second distillation took place. The lime decomposed the ammoniacal compounds, and drove off the volatile salts. These passed into a tank or saturator; and the sulphate of ammonia was decomposed by sulphuric acid, and a very noxious gas—sulphuretted hydrogen—was left. How this foul gas was to be disposed of was the next question. Before 1880, the almost universal practice had been to burn it. But then a further chemical change occurred; the sulphur forming another compound—sulphurous acid—a noxious, deleterious gas. Therefore, when the gas companies were getting rid of sulphuretted hydrogen by the crude method of burning, the result was that they were merely discharging into the air a less noxious gas than before.

Mr. HUME WILLIAMS remarked that this was one of the points in issue.

Mr. FERGUSON said that though not so unpleasant, the gas was deleterious to the public health, as well as to buildings generally, when discharged into the open air.

His HONOUR asked if the defendants denied that the burning of the sulphuretted hydrogen produced a noxious gas.

Mr. HUME WILLIAMS admitted the production of the gas, but disputed its alleged noxious qualities. It was not agreeable, of course; but by proper dilution it became quite innocuous.

Mr. FERGUSON (continuing) said that between 1880 and 1890 chemical knowledge advanced considerably, and fresh methods of dealing with these gases were discovered; and one of the Inspector's duties was to see that, in works where offensive trades were carried on, the best practicable means of preventing nuisance and danger to health were adopted. Under these circumstances, the previous Inspector under the Acts—Mr. A. E. Fletcher—informed the Commercial Gas Company that it was time a better system than that of burning the sulphuretted hydrogen was followed at their works. By a letter dated June 19, 1894, he told them that this was no longer the best practicable means of dealing with it; and he mentioned others—treatment by oxide of iron, and recovery of the sulphur by the Claus process. A choice of several systems was given them by Mr. Fletcher, who in his letters described them in detail. Expert witnesses would, of course, be called to explain the methods of carrying them out.

His HONOUR: Under the system at present in operation at the Company's works, what is the effect of the gas which passes away after the burning of the sulphuretted hydrogen?

Mr. FERGUSON said that, as would be described by the scientific and medical witnesses, it was deleterious to the health of human beings, and also to vegetation.

His HONOUR remarked that in this case the gas was not escaping into a wooded country.

Mr. FERGUSON said the defendants' works were in a populous district, near the Court—a densely populated neighbourhood.

His HONOUR: At what height does the gas escape?

Mr. HUME WILLIAMS: The chimney is about 60 feet high.

Mr. FERGUSON said the sulphurous acid gas produced by the burning of the sulphuretted hydrogen was heavier than the air, and fell to the ground, as the scientific witnesses would describe. In this way, it was more noxious than the gas which was attempted to be got rid of.

His Honour: What is the specific effect upon human beings of breathing a gas of this kind?

Mr. Ferguson: Its effect is to irritate the mucous membrane and to produce coughing and choking. It affects the blood, upsets the operations of digestion, and generally reduces the power of resistance to disease. The powers of life, in fact, become altogether reduced by it.

His Honour: Then we must all have been living in this state of things more or less?

Mr. Hume Williams: We have been carrying on these processes for twelve years past without a single complaint.

His Honour: But they have now found it out.

Mr. Ferguson: I think the origin of it has been the action of the public department which has the protection of health.

Mr. Hume Williams: If this gas is of a noxious description, it would have had an injurious effect on the surrounding inhabitants. But I say it has had no such effect on them, and therefore it cannot be noxious.

His Honour remarked that it was always very difficult to get at the effect of emanations from any one specific factory—as, for instance, in the case of Widnes and the works in that district. This Act was intended to deal with the difficulty.

Mr. Ferguson said that was so. It was the difficulty which led to the passing of the Act.

His Honour: Are you bound to point out which is the best process?

Mr. Ferguson said the Inspector was compelled to do so by section 23. He had to give notice stating the facts on which he founded his opinion and the means which he believed would suffice to remedy the nuisance. He was obliged to tell the owner what to do. A choice of three processes was offered to the defendants: First, the Claus process; secondly, the manufacture of sulphuric acid from the gases; and, thirdly, cooling the products of combustion, and passing them through a lime purifier. Mr. Fletcher stated in his letter to them that the acidity of the escaping gas was reported as being equivalent to 40 or 50 grains of sulphuric anhydride per cubic foot, and that their method of dealing with the sulphuretted hydrogen was only to be regarded as a temporary arrangement. Time had been given them on several occasions.

His Honour: In your view, the practical position of matters is that the Company are now treating as a waste product that which they could utilize by one or other of the methods you have intimated to them?

Mr. Ferguson said that was his contention. The former Chief Inspector suggested to them, in his letter of June 19, 1894, that better means than burning now existed for dealing with sulphuretted hydrogen; that in many works the gases evolved were utilized in sulphuric acid chambers for the manufacture of that acid; while in other cases the Claus process was followed, and the sulphur recovered. To this Mr. Jones, the Engineer and General Manager of the Company, replied on July 2, 1894, that, if he could with safety depart from the present plan of burning, and deal with the sulphur on a scientific basis, which was not too costly, he would be only too glad.

His Honour suggested that the correspondence need not be read, as the case must be tried on the evidence of the witnesses.

Mr. Ferguson said he would only add that in March of this year the Local Government Board put pressure on the Company to adopt better means of dealing with the gas, and suggested a plan; but nothing had been done. The Inspector gave them three months' further time for another plan to be tried. They proposed to treat their waste gases by laying down pipes from one of their works. But they found, after all, that this was not a good method; and they determined to make sulphuric acid themselves.

His Honour: I do not know what the cost may be, but I should rather infer that any one of the courses indicated in the Chief Inspector's letter would be attended with considerable expense. What do other gas companies do?

Mr. Ferguson said many of them had adopted the processes recommended to the defendants.

Mr. Hume Williams: And some of them have not.

His Honour: You must bring it to an issue as regards what can be done in this way. What do you say that gas companies do to guard against this nuisance?

Mr. Ferguson said some works converted their sulphuretted hydrogen into sulphuric acid. From 1894 down to last Christmas, the defendants had not dealt with their gases in a way that was satisfactory to the Local Government Board and the Inspector. They had refused to do first one thing and then another, and had asked for time, which was given them. About December last they finally said they had decided to commence the manufacture of sulphuric acid by one of the methods recommended. The Chief Inspector asked what they intended to do in the meantime, until the acid chambers were erected; and he suggested that a scrubber should be used to wash out the sulphurous acid while the vitriol was being made. Mr. Jones, however, did not do this, though he had said he would put the scrubber in hand at once. As nothing was done by March, the Inspector said they could not be allowed to go on burning the gases; and he asked for a pledge that the scrubber would be put up. A reply was sent that the Inspector had no right to ask for pledges; and on March 15 last the Company declined to carry on further correspondence.

His Honour: What did Mr. Jones consider was the proper thing to be done?

Mr. Hume Williams said the Company were unable to do anything, as they had found by experience how engagements entered into with them were treated. He thought the summons must really have been issued against the Company in a fit of temper.

His Honour said all considerations of this kind might be dismissed at once. He must try the case simply on the evidence.

Mr. *R. Forbes Carpenter*, F.I.C., the nominal plaintiff, examined by Mr. Ferguson, said he was Chief Inspector under the Alkali Acts; having succeeded the former Chief Inspector on June 1, 1895. He had previously been for thirteen years one of the District Inspectors under the Act. He was acquainted with the working of the Claus sulphur-recovery process, with that for the conversion of sulphuretted hydrogen into sulphuric acid, and also with the scrubbing and washing process. The three processes he recommended in his notice to the Company were practical methods for getting rid of the nuisance of foul gases arising from the manufacture of sulphate of ammonia. They were the best commercial methods known. The scrubbers were only in limited use, on account of the expense. Most works dealt with the gases by the other two methods.

His Honour: Is the third method unproductive to the manufacturer?

Witness said it would be; but the first two were productive.

Examination resumed: Burning was not, in his experience, the best method of dealing with the sulphuretted hydrogen, because it involved the discharge of sulphurous acid into the atmosphere. Such emanations were deleterious. The acid produced picked up moisture and oxygen from the atmosphere, and became sulphuric acid. Both sulphurous and sulphuric acid were soluble to a certain extent. Sulphurous acid gas was twice as heavy as air; and sulphuric acid was still heavier. Whether sulphurous acid discharged from a high chimney would diffuse upwards rapidly depended upon the state of the atmosphere. Under some conditions, it would traverse the air like a stream, without being much diffused.

His Honour said, if the Company were proved guilty of the offence with which they were charged, it would be for the Court to fix the amount of the fine.

Mr. Ferguson said that would not depend merely upon whether they were letting out gas at a certain hour on a particular day, but upon what their conduct had been; and upon this point the correspondence was important. The real inquiry here was whether the Company were using the best means of dealing with their waste products.

His Honour remarked that this was a very important case; and, as it could not be finished that day, it would be advisable to adjourn it until the following Thursday.

After some discussion, it was agreed that the scientific witnesses specially in attendance should be examined at once, and that the rest of the plaintiff's and the other evidence should be postponed.

Dr. *Tatham*, examined by Mr. Ferguson, said he was Statistical Superintendent at the Registrar-General's Department, Somerset House, and had had twenty years' experience as a Medical Officer of Health in Manchester and in the North of England. In his opinion, both sulphurous acid gas and sulphuretted hydrogen were noxious. The former irritated the mucous membrane; and its absorption into the system altered the condition of the blood and the fluids of the body. This alteration caused general derangement, and depression of the whole system, and especially affected the mucous membrane of the diaphragm. Whether sulphuretted hydrogen or the sulphurous acid gas produced from it were the more deleterious would depend entirely upon quantity; but he was prepared to say that they were both noxious gases. Sulphurous acid had a bleaching effect on buildings; and he thought it would cause rapid rusting of iron-work—iron bridges, and so forth.

Cross-examined by Mr. Hume Williams: Whether or not sulphurous acid gas was noxious to human beings depended upon quantity. As to its being injurious to them or to vegetation when mixed with the atmosphere to the extent of 2 or 3 grains per cubic foot, he thought that any quantity which was perceptible would be noxious. It was a question of degree. By the Alkali Act, alkali works were allowed to discharge up to 4 grains of sulphuric anhydride per cubic foot; but he was prepared to say that considerably less than that would be harmful, despite the Act of Parliament.

His Honour remarked that the question whether the Act allowed these gases to be discharged in sufficient quantity to do damage was rather one for a chemical expert.

Cross-examination resumed: If the amount of sulphuretted hydrogen or sulphurous acid escaping from a chimney was sufficient to be noxious or harmful to human beings, vegetation, ironwork, and buildings in the neighbourhood, signs of the deleterious effects should be apparent. The fact that ironwork and vegetation near the base of the chimney of a chemical works were untouched would not lead him to infer that the quantity of gas escaping was not harmful. If the vegetation and gardens in the immediate neighbourhood of the chimney from which these gases issued were found to be healthy, he would not say there were no harmful gases, but only that the vegetation had not suffered from sulphurous acid. He had not seen the vegetation round these particular works, and knew nothing whatever about its condition; nor was he able, from personal examination, to say whether the health of the people in this district of London had been affected. Sulphurous acid in small quantities was antiseptic. No doubt a certain amount of this acid issued from ordinary house chimneys when coal fires were burning. He did not know whether it would be as much as 1 grain per cubic foot. The combustion of coal, perhaps, gave out that quantity.

Re-examined by Mr. Ferguson: Sulphurous acid was only antiseptic when concentrated; and that which was discharged from a chemical-works chimney was not calculated to improve the health of people or vegetation. In fact, the presence of sulphurous acid in the air was noxious, and dangerous to health.

Dr. *Ransome*, examined by Mr. Ferguson, said he was Consulting Physician to a hospital for diseases of the chest in Manchester, and Chairman of the Sanitary Association at the same place, in connection with which he had had 36 years' experience. He had during this time devoted special attention to the influence of polluted atmospheres among populations. Sulphurous acid was one of the chief impurities in the air of manufacturing towns. It had a bad effect upon the chest and throat, and affected people constitutionally. It produced anæmia, and some other forms of dyspepsia among those who inhaled it constantly in small quantities. It also affected the respiratory organs, induced a feebler bodily condition, and rendered a person generally more susceptible to disease. His opinions upon the subject were shared by others—medical men of eminence.

Cross-examined by Mr. Hume Williams: Nobody doubted that air and light were good for people. The Alkali Act permitted sulphurous acid up to 4 grains per cubic foot to be discharged from factory chimneys into the atmosphere. So long as factory owners did not exceed this quantity, they could not be prosecuted; but he should be glad to see the law altered, and a much lower maximum fixed. Whether the discharge of sulphurous acid gas into the air was noxious, was a question of quantity per cubic foot contained in it.

His Honour pointed out the difficulty that, though the discharge from a chimney might only be at the rate of 4 grains per cubic foot, the ratio where it fell would depend upon accident, and the conditions of the atmosphere in the particular district. The same ratio of diffusion in its downward course would not apply.

Mr. Hume Williams: No human ingenuity could guard against that.]

Cross-examination resumed: Even if these fumes were emitted in sufficient quantity to be harmful, they would not be immediately smelt. They were undoubtedly appreciable in fogs. He had noticed the effects upon the calf bindings of books when the acid was not otherwise perceptible. He had observed the effect upon iron; but whether or not the same amount of acid in the air would be required in order to effect a sensitive human being, he could not say. The appreciable result upon gardens in the neighbourhood would be that the vegetation would be harmfully effected. There was no doubt whatever of its bad effect, in certain quantities, upon human health.

Re-examined by Mr. FERGUSON: Some plants and vegetables resisted the action of these gases better than others.

By his HONOUR: The difficulty of growing plants in towns was owing to the diffusion of sulphurous acid gas in the atmosphere.

Re-examination resumed: Though not injurious to vegetation, sulphurous acid gas might be harmful to human beings; and the fact that vegetation would grow in a district was no proof that the human organism was not affected by it. The 4-grain limit prescribed in the Act was an outside quantity. The average amount discharged from works was 1·1 grains. The Chief Inspector's report stated it to be about 1 grain.

His HONOUR: Is it alleged that the defendants send out as much as 4 grains?

Mr. HUME WILLIAMS: Yes; and sometimes more.

His HONOUR: Then would they not be liable under the Act for doing so?

Mr. HUME WILLIAMS said the defendants were not protected by the Act in any way, as they were not sulphuric acid manufacturers.

His HONOUR (to witness): Suppose that, in a densely inhabited part of London like Poplar, there were no works or manufactories of any kind, but that thousands of coal fires were burning in the houses, quite apart from any factory chimneys. Would there be an appreciable amount of sulphurous acid gas discharged into the air?

Witness said he certainly thought so; but it would depend to a great extent upon where the coal came from. He did not think ordinary coal would give off as much as 1 or 1½ grains per cubic foot.

Specimen flowers taken from gardens near defendants' works were handed to witness.

His HONOUR asked how far the gardens were from the gas-works.

Mr. HUME WILLIAMS said about 150 feet.

His HONOUR: Then they would be absolutely free from the effects, would they not? The fumes would pass away over them.

Mr. HUME WILLIAMS said the gas was represented as being so heavy that it would fall to the ground before it could pass over 150 feet.

His HONOUR: Perhaps somebody can give us information upon that point.

Mr. HUME WILLIAMS said a large number of witnesses could be called in regard to the effects on vegetation in the district.

Mr. FERGUSON said the effects would be spoken to miles away from works of this kind.

Professor *Haldane*, F.R S., examined by Mr. COLEFAX, said he was Lecturer on Physiology in the University of Oxford, and a member of the Board of Trade Committee on the Ventilation of Towns. In this capacity, he had specially to investigate the effects of sulphurous acid formed in the combustion of coal. Apart from that, he had given particular attention to the effects upon human beings of noxious gases in the atmosphere. Sulphuretted hydrogen, sulphurous acid gas, and sulphuric acid in the air were certainly poisonous, even when considerably diluted. In the proportion of 4·25 grains per cubic foot discharged from a factory chimney, the effect would be dangerous to man, and would probably produce death in a short time, if constantly breathed. To some persons, 4 grains of sulphur dioxide in 500 parts would be dangerous. The extreme amount generally permitted was 4·3 grains. This would be about 1 part in 350 parts. Breathing this mixture would prove fatal to man in a few minutes, judging by the effects upon animals—that was, the full strength of it. Further dilution by mixture with 100 parts would produce violent sneezing, coughing, and irritation of the throat passages and lungs. People would be very glad to get out of such an atmosphere. Gases evolved from chimneys had not the same chance of dilution in foggy as in fine weather. Carbonic acid gas was not diluted to more than 100 parts. This was the average dilution of these gases. With whatever dilution they were likely to receive, breathing the air would still produce coughing and choking. Both sulphurous acid and oil of vitriol (sulphuric acid) were exceedingly irritant.

Cross-examined by Mr. HUME WILLIAMS: As soon as the gas left the chimney, it began to be diluted by the air; and it would not reach the ground at anything like the proportion named. How far it would travel first would depend on the state of the weather; and the possibility of its travelling 150 feet would depend also on the height of the chimney.

His HONOUR (showing witness one of the specimen garden flowers produced): Would you expect to find a pansy like this growing within 50 feet of the chimney?

Witness said he should not. All the time the gas was travelling, it was undergoing dilution in the air. If the density was 3 grains on its emerging from the chimney, it would probably be only half a grain, or even less, when it reached the ground. In ordinary atmospheric conditions, there would be as much dilution as that.

Mr. HUME WILLIAMS: Then practically by the time it reached the earth the quantity would be inappreciable?

Witness said with this dilution the air would still be poisonous.

His HONOUR asked if a moist condition of the atmosphere would affect the distribution of the gas.

Witness replied that if the air were dry, the gas would be readily distributed upwards; but in times of fog it did not go up in the ordinary way. Then the sulphurous acid particles would descend. If the day were fine, most of the sulphurous acid gas would ascend. Though it was heavier than the air, it would be carried up; but some of it would be deposited on the ground. If it fell to the ground in a solid body, it would be fatal to life.

His HONOUR: The main question is whether or not, on touching the surface, the discharged gas would affect life, health, or property. It is, I suppose, on common ground that the greater portion of it disperses.

Cross-examination resumed: By the time any of the sulphurous acid reached the ground, it would be greatly diluted by the atmosphere. The proportion remaining on a dull day would be enormous along the line of the smoke; and it would have a most irritating action on any person. Besides its noxious influence upon men and vegetation, it would have an appreciable effect upon metal and stonework in the neighbourhood, if in sufficient quantity per cubic foot of air to be harmful. If such a process had been going on for ten or twelve years, he should expect to see appreciable results on the iron and stone in the neighbourhood. The sulphuretted hydrogen was burnt up in the works, and became sulphurous acid, which was less unpleasant, no doubt; but the two gases were about equally poisonous. Sulphurous acid gas was so irritating that persons could not remain in a dangerous percentage of it. Both gases were capable of dilution with the same facility with air.

Mr. HUME WILLIAMS asked, if both were equally poisonous, what was the object of burning the sulphuretted hydrogen.

Witness said its odour was generally admitted to be very objectionable.

Do you mean to say that the only object of burning the sulphuretted hydrogen is to destroy the smell?—Not to destroy it, but to convert it into something different. The smell of sulphuretted hydrogen is that of rotten eggs; while sulphurous acid smells like brimstone matches.

So that the process in this country of burning this gas is simply to convert one bad smell into another?—It might be put in that way.

Cross-examination continued: With regard to diluting the sulphurous acid gas with air when passed through a chimney, such a system, if properly carried out, might be effective. In towns, the least quantity of sulphur discharged into the air must have some effect. As to minimizing the evil by turning the gas into a chimney, sufficiently diluting it, and then allowing it to go into the air, this would all depend upon the quantity discharged from the chimney. He would judge the results by an analysis of the gases issuing from the chimney. Comparing this process with that of turning the gas into a sulphuric acid chamber, as suggested by the Local Government Board, the manufacture of sulphuric acid involved the evolution of very noxious fumes, nitrous oxide and others. These fumes were bad-smelling and deleterious, depending upon the quantity, which was a question of dilution with the air. Where 5 tons might be discharged by the other process, by the sulphuric acid process only a fraction of a ton would perhaps be discharged; and if only a small quantity of the acid were sent out, the nuisance to the neighbourhood would be diminished. This would not mean that the works were not to be so much employed. The absolute amount of sulphur discharged from sulphuric acid works was minute in proportion to the present discharge from the defendants' chimney.

His HONOUR asked if there were any means of capturing the gas outside the chimney?

Witness said there were; not without regard to the condition of the atmosphere or the elements in the air, but on a favourable day.

Professor *Ramsay*, F.R.S., Ph.D., examined by Mr. COLEFAX, said he had for many years taken great interest in the subject of air pollution. The emission of 4¼ grains of sulphurous acid per cubic foot would make the air irritating, and exceedingly disagreeable to breathe; and it would blast trees near the works, particularly on the north and north-east sides, according to the prevailing winds in this country. The diffusion and dilution of the gases escaping from the defendants' chimney would depend upon the weather. Sometimes they would not be carried very far, and at others the lines of smoke would travel for rather long distances. During fogs, they would be deposited on the ground in an undiluted state.

His HONOUR asked if the same result would not occur from locomotives passing along in the ordinary way.

Witness said all coal contained some amount of sulphuric acid. If there were no sulphurous acid in the fumes, they would not be harmful from a medical point of view. These fumes would, he thought, be injurious to a nursery garden, but he was not a horticulturist.

[Witness produced several glass vessels containing samples of smoke from house and factory chimneys, and explained to the Court the effects of their mixture with the air.]

Examination resumed: Iron and other metals would be rusted by these gases; and book-bindings and woollen goods would be caused to decay. He confirmed the evidence of the previous witnesses as to the bad effects of such gases in fogs. Common chimney smoke contained only 0·5 grain of sulphurous acid, as against the 4¼ grains mentioned as being discharged from factories and works per cubic foot of air. He described the Claus process of dealing with sulphuretted hydrogen, which had been recommended to the defendants for adoption. The chamber process was now in successful use. The process of making oil of vitriol was quite feasible, and would be perfectly applicable in this case. Burning the gases in limestone towers would prevent the sulphurous acid from escaping. But this was not an economical process; whereas that for the formation of sulphuric acid would be in many cases. He could not say whether or not it would be so in the present case.

Cross-examined by Mr. HUME WILLIAMS: He looked carefully at trees in the neighbourhood of works discharging sulphurous acid, and had found them blighted upwards of 200 yards away. He cited instances on the banks of the Avon, near Bristol. When noxious gases had been emitted for any time from works, there could be no mistake about the effects in the neighbourhood. Ordinary chimneys gave out on an average, 0·2 or 0·3 grain of sulphurous acid gas per cubic foot of air.

His HONOUR pointed out that, independently of gas and other works, a large source of pollution would arise from small houses if fire-burning were continuous.

Cross-examination resumed: There must be a large quantity of smoke containing sulphurous acid issuing from works in the Metropolis without appreciable effect on the health of the people in the neighbourhood. This was because they had tall chimneys, and the moment the gas issued from them, the process of dilution began, depending on the state of the weather. The manufacture of sulphuric acid need not necessarily be deleterious. Risk would only arise in clearing out the sulphur deposits, &c., and from the inhalation of nitrates as the result of carelessness. Loss of life could only occur in this way. There would be no noxious fumes after the process was complete. The limit of 4 grains was placed so high by the Local Government Board in order that it should not be easy for alkali manufacturers to exceed it; and they now, in fact, sent out much less than that quantity. The tower process was perfectly practicable, but not very economical. After it was complete, a residual liquid was left. He should not call it offensive; but it was difficult to deal with in any quantity. He could not say whether it was not allowed to be passed into the public sewers.

Re-examined by Mr. FERGUSON: If the amount of gas escaping from a chimney were still further diluted in the atmosphere, the nuisance and danger arising from it would, of course, be less.

The further hearing of the case was then adjourned.

Thursday, July 1.

The further hearing was resumed to-day at the Law Institution, Chancery Lane.

Mr. FERGUSON said he proposed to call Mr. Fletcher, the plaintiff's predecessor in the office of Chief Inspector, to prove the correspondence which had passed with the Company in reference to the requirements made upon them for the proper disposal of escaping gases.

His HONOUR asked to be referred in the first place to the section of the Act under which the summons had been taken out.

Mr. FERGUSON said section 9 provided that the owners of works scheduled under the Act should adopt the "best practicable means" of preventing atmospheric pollution. Part 5 applied to sulphate of ammonia works, which the defendants carried on; and the sulphuretted hydrogen which was the cause of the nuisance was the product of that manufacture. This was a noxious gas which had to be got rid of, and the defendants had been in the habit for many years of burning it; the result being the production of sulphurous acid gas.

His HONOUR asked when the Company first began to make sulphate of ammonia.

Mr. HUME WILLIAMS said about twelve years ago. By a process which need not be detailed, the ammoniacal liquor produced in gas manufacture was converted into sulphate of ammonia—a commercial product. In the process, sulphuretted hydrogen and a very small quantity of carbonic acid gas were given off. The carbonic acid need not be further referred to; but the sulphuretted hydrogen was an evil-smelling gas which had to be disposed of. It was first driven into a chamber where it was made very inflammable, and was then passed on to a second chamber where it was burnt very much like coal gas; the result being sulphurous acid gas, which passed into a chimney 60 feet high, and was there largely diluted with air. When it reached the top of the chimney, the average quantity of gas was 2 grains per cubic foot of air. From the time of its leaving the chimney, the process of dilution continued; and when it reached the ground, the gas became practically innocuous.

His HONOUR said he understood from the opening speech that the proportion of sulphurous acid, or sulphuric anhydride, escaping from the defendants' chimney was 4·3 grains per cubic foot of air.

Mr. FERGUSON said that was on a particular occasion. The offence occurred on a day when this proportion was reached. He proposed now to prove formally the correspondence which had taken place with the Company.

Mr. HUME WILLIAMS said the correspondence was admitted, and could be referred to as required.

Mr. *A. E. Fletcher*, F.I.C., F.C.S., examined by Mr. FERGUSON, said he had been Chief Inspector under the Alkali Acts from 1884 to 1895. After the passing of the Act of 1881, he had to consider the question of the escape of noxious gases from works and factories; and he had dealt with the subject in his report, which he now put in evidence.

Cross-examined by Mr. HUME WILLIAMS: As far back as 1894, Mr. Jones, the Company's Engineer and General Manager, and he were taking divergent views as to the best process to be adopted for dealing with the noxious gases. In a letter of the 19th of July of that year, two firms were mentioned as using oxide of iron solvents. In the instances referred to, the emission of the gas was only intermittent; but it was constant in the defendants' works. Witness had pointed out that the acidity of the fumes discharged from their works at Stepney and Poplar was very large—as much as 40 or 50 grains of sulphuric anhydride per cubic foot. This was an enormous quantity. The method of burning the sulphuric anhydride could not be called the best, in view of results obtained by the other processes in use. About that time he met Mr. Jones by appointment at the offices of the Local Government Board, when he promised to take the matter in hand. Again, on Dec. 12, 1894, witness protested against the pollution of the atmosphere to such an extent, and said that, failing an arrangement being come to for obviating it, the question had better be raised upon a summons, for a decision under the provisions of the Act. The Company were not being specially attacked, as other manufacturers were constantly being complained of and brought to book. In fact, as far back as December, 1894, Mr. Jones expressed doubt as to the efficacy of the plans suggested by the Local Government Board. Tests were frequently taken of the amount of sulphurous acid gas escaping from the defendants' chimney. During the whole of the time he was Chief Inspector, he never detected sulphuretted hydrogen. In other works where sulphuretted hydrogen was burnt in a similar manner to that adopted by the defendants, traces of it were found escaping from the chimneys.

By His HONOUR: If the process of burning the sulphuretted hydrogen were properly carried out, none of it would escape by the chimney.

Cross-examination resumed: If any escaped, there must be some defect in the process. If he had thought during the eleven years of his chief inspectorship that the defendants were not using the best practicable means of preventing pollution of the atmosphere, it would have been his duty to take proceedings against them under the Act. When the Act of 1892 came into force, the various processes in existence were still on trial. Complaint was then made to Mr. Jones for allowing too large a quantity of noxious gas to emanate from his works; and he promised to do his best to prevent it. But as time went on, and nothing was done, the Department grew tired of his promises, and the present prosecution was resolved upon. He felt sure from the first that the defendants were not using the best possible process. But Mr. Jones always said he was anxious to do all he could; and he (witness) believed various processes had been adopted for the purpose of finding out the best way of proceeding. But, notwithstanding the remonstrances continually made, and the respites given to them from time to time, nothing had been done. By the Act of 1881, an annual certificate was required from the Department to enable the owner to carry on his works. Alkali works must be registered, and could not be carried on without a certificate.

His HONOUR: I do not find any power given to the Department to refuse the certificate on the ground that the Inspector is not satisfied.

Mr. HUME WILLIAMS said they could either refuse the certificate altogether or grant it on terms.

Witness said he had raised this question at the Local Government Board; but they thought it better to have it decided upon a prosecution under the Act.

His HONOUR: Where is power given to refuse the certificate?

Mr. HUME WILLIAMS said it must be that power was given to refuse if it were thought necessary; otherwise there would be no object in providing that certificates might be granted annually.

Mr. FERGUSON said the matter had been considered by the Board, and they preferred not to take the course of refusing a certificate, but to raise the question upon a summons in this way.

His HONOUR: Otherwise they might, if they chose, stop one of the largest works in London by the exercise of a tyrannical power. One would be amazed to find that such a power was given to any public Department and without appeal.

Mr. HUME WILLIAMS pointed out that by section 12 alkali works were not to be registered unless the Inspector was satisfied that they were being carried on in accordance with the Act.

His HONOUR remarked that, though the Department could not cancel the old certificate, they might, under section 12, refuse to renew it, or grant a new one. But even this would be a very arbitrary power to exercise.

Mr. HUME WILLIAMS said no proceedings whatever had been taken for ten years; and surely, if works were being carried on improperly, the simplest way to deal with them would be to stop them, as a public nuisance.

His HONOUR thought that would be a very high-handed proceeding.

Mr. HUME WILLIAMS said that in this case the Department had neither thought it right to refuse the certificate nor to take proceedings.

His HONOUR: Having regard to the Act itself, the witness says there was no urgency during the ten years; and though he felt dissatisfied, he gave the Company every opportunity of putting their works upon a proper footing.

Cross-examination resumed: As soon as the nuisance was realized, Mr. Jones was remonstrated with. Large quantities of sulphuric acid were produced under the Claus process. It was not impossible to burn the sulphuretted hydrogen by itself, though it was usual to burn it with other substances, and the treatment of the additional sulphur brought into the works to produce the sulphuric acid involved the escape of more sulphuric acid from the chimneys; but it was a fractional percentage.

Re-examined by Mr. FERGUSON: The amount of sulphur escaping into the air from a well-conducted sulphuric acid chamber would not amount to 0·5 per cent. of the sulphur used.

His HONOUR: That conveys nothing to my mind. What I understand the witness to say is that the amount of sulphuric acid gas escaping from properly-conducted works has not been found at all injurious. I cannot understand mere percentages unless further light is thrown upon them.

Re-examination resumed: The small quantity of sulphuric acid gas discharged from properly-conducted works would not be a nuisance. With regard to the percentage, the Act allowed a wide limit; but if 1 grain per cubic foot were found to be escaping, representations were at once made to the owners or manufacturers, calling their attention to the fact that waste was going on. The average amount discharged was less than 1 grain.

Mr. HUME WILLIAMS said that in 1892 the average shown by the annual report of the Chief Inspector was 1·38 grains; while in 1891 it was 3·1 grains.

Re-examination resumed: He would not say he should consider it a cause of complaint, in face of this statement, if works discharged as much as 1 grain. The best works did not emit so much as that. It paid better to exercise more supervision, and prevent waste with these large companies than in the case of smaller works. This was the proportion measured in the chamber itself, before dilution in the chimney. If it were the quantity in the chamber, there would be in the chimney only a small quantity compared with the other gases. Of the entire 1½ grains which might be found there, the small quantity of the gas present would be unappreciable. It had taken some years to ascertain the best method of making oil of vitriol, and to find out that limestone scrubbing-towers should be used. These noxious gases could be dealt with much more satisfactorily now than could be done some years ago.

Plaintiff was then recalled, and his examination continued by Mr. FERGUSON. He said he was acquainted with the various methods in use for dealing with sulphuretted hydrogen, sulphur, and ammonia products. Throughout the country, there were at present 22 works using the Claus process; but only 20 were given, by mistake, in the report for 1896. The process of conversion into oil of vitriol was used in 23 works, which were naturally the largest. The proportion of the total make of sulphate varied from 40 to 61·7 per cent.; and as regarded the Claus process, the quantities were 6·5, 9·8, 15·6, and 12·2, or an average of 11 per cent.

His HONOUR: Can you give me the result of these percentages in relation to other large works throughout the country?

Witness said he was unable to give precise figures. The Claus process consisted in burning the sulphuretted hydrogen; leaving the sulphur to separate out. The gases, mixed with a proper proportion of air, were then passed through a kiln containing oxide of iron, in which a reaction took place. The melted sulphur was then passed out, and taken away partly in blocks and partly in fine flour, and was sent on into a chamber. During all the time flowers of sulphur were being deposited. A considerable proportion of sulphuretted hydrogen and sulphurous acid which had escaped decomposition then remained at the outlet of the flowers chamber, and had to be dealt with. A limestone tower, fitted at the top with a scrubber, was employed for the purpose; and the resultant gas was then passed into an oxide of iron purifier, which removed the remaining sulphuretted hydrogen.

His HONOUR: What would be the expenditure entailed in providing appliances of this kind in the defendants' works?

Mr. HUME WILLIAMS said that matter would be brought out in cross-examination.

Examination resumed: The oil of vitriol process was first to remove the water, and afterwards the gas was passed through sulphur pyrites or oxide; and it was usual to distribute the gas among the burners, of which there were always a sufficient number to deal with it. The mingled gases then travelled on. For this process an agent was needed to bring out the necessary combination; and for this purpose oxide of nitrogen or

nitrous oxide was used. These agents acted as carriers for the air which was taken up by the sulphurous acid. It then fell to the bottom of the chamber in the form of rain. In the chamber process, the quantity of sulphurous acid was perpetually diminishing until at last it reached a point where from 0·5 to 1 per cent. only escaped.

His Honour asked whether the gas was innocuous when it finally escaped, and was not then a subject of complaint?

Examination resumed: Each of these processes was commercially profitable. The third process, which had been used in recent years for a special purpose, was to take the gases, after complete combustion into sulphuretted hydrogen, and to pass them into a tower filled with limestone, in which the whole of the acidity was removed. The first two processes were commercially profitable; but the commercial use of the third was limited to rinsing beer-barrels. By the vitriol process, only from 0·5 to 1 per cent. of gas escaped; in the case of the Claus process, the gas was altogether arrested—that was to say, 99½ per cent. of the nuisance would be stopped. This would be the result if the process were adopted.

His Honour: There is a fourth way, I think, in which the difficulty may be dealt with, for the purpose of eliminating more of the noxious gas complained of at the defendants' works. Supposing the present mode of working be continued, could any increased expenditure or any difference in the method of procedure give better results?

Mr. Ferguson said the whole matter was based on the combustion method. The contention of the Local Government Board was that mere dilution of the gas, to whatever extent, was not sufficient.

His Honour: Then you do not think that, with the present mode of dealing with the gas, greater expenditure would enable the defendants to obviate the evil complained of? Assuming that the Company were now working with certain appliances, if they went on, without having regard to any of the other three courses indicated to them, working in a better way, with better materials, and so on, could they make the present system efficient?

Witness: We do not complain that sulphuretted hydrogen escapes decomposition in the furnace, and therefore we do not say that the Company do not carry out that part of it.

But, as they are working at present, could they do anything else to prevent the emission of the sulphuric acid gas?—A limestone tower is the best method. Dilution is not the best course to adopt.

His Honour: Then some radical change would have to be made at the works in order to meet the difficulty?

Mr. Ferguson said that was so. The Company were bound to adopt more practical means to prevent the sulphur escaping into the air.

Examination resumed: The Local Government Board would not be content until this was done; and no possible modification of the Company's present system could do it. It was the duty of the Inspectors to apply chemical tests to ascertain the quantities of gas escaping into the air. Mr. Fletcher, the former Chief Inspector, had devised a portable aspirator for this purpose. [Witness produced one of the aspirators referred to, and explained its construction and action.] This apparatus was in daily use. In testing chimney smoke, the tests were made 20 feet from the ground. This was the result of many years' experience. [Witness produced reports and tables showing the average quantity of sulphur contained in chimney gases at sulphuric acid works.] The Inspectors had to keep watch on the amount of acidity in both chimney and waste gases. The average during two years was hardly as much as that from the tests of ordinary coal fires. This would give an idea of the degree of dilution which these gases had to undergo before they were allowed to pass into the air. With regard to the questions put to Professor Ramsay, as to whether accidents did not happen in the manufacture of vitriol, of course, the chambers had to be cleaned out, and danger arose in consequence. As to the effect of the acid gases on vegetation, he gave instances from Phillips's Park, in the east of Manchester. The amount of acid in the atmosphere in this district arising from the combustion of coal, or the smoke coming from the mill chimneys, was so large that it was not surprising to find that the plants and trees in the Park had a struggle for existence. Some plants throve better than others in an atmosphere of this kind; and those formerly there had been taken out, and stronger ones planted, which would thrive in an acid-polluted atmosphere. The result had been a very fine show of tulips. From the Park 137 factory chimneys could be counted. The inference was that it could not be said that sulphurous acid was not present because certain plants would grow in the neighbourhood. The test of the amount of pollution was the number of tons per acre burnt. In winter time, with fogs prevailing and soot condensing on hollies and evergreens, they had a very poor chance in such a district.

Cross-examined by Mr. Hume Williams: His notice to the defendants referred to the means which would suffice to prevent the discharge into the atmosphere of sulphuretted hydrogen. Though this was evolved in the works, it was not actually sent into the outer air. He did not believe in the efficacy of dilution. If the gas was diluted to vanishing-point when it reached the chimney, he would still say that he would not have it, following the views held by his Department since 1882. Dr. Angus Smith was the first man of eminence who dealt with the subject as far back as 1854. He could not explain how, if the gas was diluted to vanishing-point, it could be said to be harmful or offensive. The Department, however, did not approve of dilution in any form. He objected to it because he could not say that it would enable the gas to be rendered harmless. It must be remembered that dilution did not absolutely prevent a certain quantity of gas being discharged into the air; and when better means existed for preventing the discharge, they should be used. Defendant's method did not render the gas harmless.

His Honour: Supposing 10 grains went up solid, they might do harm; but if mixed with 500 volumes of air, that would have only one-fiftieth of the effect.

Witness said the 10 grains would still be passing out of the chimney, notwithstanding the admixture with the air. A certain amount of danger arose from the gas evolved in the works; and this had therefore to be reckoned with. He agreed with what the previous witnesses had said as to the evil effects of the gas upon human beings, vegetation, iron, and stone. He said this, speaking from 13 years' experience in Manchester. An examination had been made of the whole district surrounding the defendants' works at Poplar, for the purpose of ascertaining whether or not the effects spoken to existed there.

Mr. Hume Williams: Did you not, before taking these very serious proceedings against the Company, go there for the purpose of observing whether or not the evil effects stated were to be found?

Witness said he knew from the reports of his District Inspectors what the effects must be. He did not speak from his experience in Manchester, but from these reports. The Act required that the best means should be employed for rendering the gases harmless and inoffensive when discharged into the atmosphere; and with regard to rendering them harmless by dilution, he looked not to the traditions of his Department, but to actual results.

If you agree that the means adopted render the gases practically harmless, you would not mind which of the three processes we employed?—It would be the Company's duty, under the Act of Parliament, to put the best method into operation.

So that, even if our process is proved, to the satisfaction of the learned Judge, to be at present harming no human being, you still think some other process must be adopted because the Department think it is practicable?—The best means must be adopted, under the Act.

Then we may be called upon, whenever the Department please, to adopt the newest and latest fad?—The different processes in use for the purpose have been brought to the attention of the defendants. Witness proceeded to give the number of works using the various processes. He said five were burning their sulphuretted hydrogen, and among them only one was in the behind-hand position of the Commercial Gas Company.

Cross-examination continued: Mr. Napier Sutton had seen the works now in process of construction by the Company, and had even made suggestions in reference to them. He (witness) had been told that the Company were putting up a limestone tower, at a cost of £5000, though they most heartily disbelieved in it, simply to please the Local Government Board. The Company said they had so far spent £3000 on the work.

Mr. Hume Williams: So that when we have spent £3000, and are going to spend £5000, on this work, to please you, you think this is a proper time to take these proceedings against us?

Witness said nothing had been done with regard to the limestone tower down to March last. The sulphuric acid works, which were being constructed, were, no doubt, also very expensive. After the lapse of twelve years the Department had issued this summons because of the time which must necessarily elapse before the sulphuric acid plant could be erected. In consequence of the whole of the Company's works being now concentrated at Poplar (their Stepney works being closed), there would be a large discharge from the manufacture. Whether they should have two sulphuric acid works, was a matter for their own discretion.

His Honour: Do I understand that the Company are willing to comply with the requirements of the Local Government Board?

Mr. Hume Williams: We are actually doing so.

His Honour: Do you admit, then, that you are bound to comply with the requisition in the notice to you?

Mr. Hume Williams: Certainly not.

His Honour: The Local Government Board have made a requisition upon you, under section 9 of the Act, to adopt the best practicable means for preventing the escape of noxious acid from your works.

Mr. Hume Williams: That was long after we had consented to do what they wanted.

His Honour: When the work is done which you are now carrying out, will it be effective, in the opinion of the Department, for the purpose for which it is required?

Mr. Hume Williams said it would. The works came under the head of "vitriol chambers" in the schedule.

His Honour asked witness whether, if the Company were doing with all practicable speed what the Department wanted, this would not satisfy them?

Witness said this was the question at issue.

Do you then consider that they are playing with you, and that it is not a real attempt to comply with your requirements?—That is the question which has brought us here to-day.

Mr. Hume Williams: We have spent £3000 upon this work already.

His Honour: Then in complying with their requisition you are practically admitting that the Department are right.

Mr. Hume Williams said that ever since 1894 the Department had been calling for these various processes to be worked by the Company; but, though they considered their own process equally effective, they thought they would, as a large Company, be very foolish if they were to be perpetually quarrelling with the District Inspectors. So at last, rather than have this continual worry and trouble with them, they said they would carry out the work at a cost of £5000, of which they had, as he had said, already expended £3000. It was commenced in December last, and would be finished in the autumn. The latter part of the work was being done under contract; but the first portion was very difficult, having to be executed in a swampy district, and the Company had done it themselves. It would be completed in about two months; but the Local Government Board had, notwithstanding, thought fit to issue this summons against them.

His Honour remarked that, judging by the correspondence which had gone on since 1894, he could not say there had been undue haste on the part of the Department. They were bound by the Act of Parliament, and their Inspector's duty was to see that it was complied with. As far as he could see at present, this litigation did not promise to be very fruitful; and in the event of future proceedings being taken, the Company would still have their right reserved to contend that their own system was the best, though they were, in fact, complying with the requisition. If they were honestly trying to do this—if that was really their intention—the Department could ask for no more. The best course would be for three months' further grace to be given them, and see what was done by that time. If necessary, the case could then be brought on again. This, of course, was subject to anything Mr. Ferguson might say.

Mr. Ferguson said the Company had not used due diligence in the matter.

His Honour said he quite agreed with that; but he had a discretion in the matter, and if he found that the Company were now fairly endeavouring to carry out the requirements made of them by the Department, in the public interest, as guardians of the public health, he would use his discretion by giving them a full opportunity of satisfying those requirements. With this view, he proposed to order an adjournment for three months—one month beyond the time mentioned as necessary for

carrying out the work. In the meanwhile, the action would remain alive, and could be brought on again under the altered circumstances. If a real attempt was going to be made, in good faith, to comply with the Department's demands, the less irritation and controversy there was at present the better.

Mr. FERGUSON quite agreed.

His HONOUR added that it would have been better had matters not gone so far as the correspondence disclosed. However, the case had now been thoroughly ventilated, and it would be advisable that no opportunity should be given for provoking feelings of exasperation. Of course, though the Company were carrying out this work, they did not admit thereby that they had been in the wrong.

Mr. HUME WILLIAMS said not in the least; that must be quite understood. To meet the Court, the Company would even give an undertaking to carry out the work to the satisfaction of any officer the Department chose to appoint to go to the place and see what was being done. This would, however, not be in any way admitting that the Company were to blame.

His HONOUR said the Company would be quite protected, after what had taken place. This course had been adopted at his suggestion; and they could not be prejudiced in the least. Whom did the Department propose to nominate to inspect the works?

Mr. FERGUSON supposed they would appoint the Chief Inspector and the District Inspector together.

Mr. HUME WILLIAMS had no wish to improve upon that suggestion.

His HONOUR asked again what time would be required for the completion of the work.

Mr. *H. E. Jones* said three months would suffice.

His HONOUR: Then I will adjourn the case to the end of October. By that time the works will be in perfect working order.

Mr. *Jones* said they would.

Mr. FERGUSON pointed out that the object of the Department, in taking these proceedings, was to get a decision; and without it other owners of works might suppose they were not absolutely bound to use the best means of preventing nuisance, and that a gas company might go on burning their sulphuretted hydrogen.

His HONOUR: In any case which might come before me, I should decide that the manufacturer is bound to use the best practicable means. If he is a wise man, he will follow the indications given him by the Department, and then he will be safe.

Mr. FERGUSON: Then, Sir, what is to be done with regard to the particular offence which has been committed here?

Mr. HUME WILLIAMS: What offence?

His HONOUR: I cannot deal with that at present, as it would entail going into the entire question under the Act. This is not like a case in the Police Court, where there is a fine inflicted for a given thing; because what I have to consider here is whether the Company have or have not adopted the best means under section 9. If by inadvertence at any given date an excessive or improper quantity of gas was allowed to escape from the defendants' chimney, that would not come under section 9. If, for instance, it happened that, owing to some of the men, for any reason, such as not watching the burning chamber properly for a few moments, an improper amount of sulphuretted hydrogen was allowed to escape up the flue, it would not come under the section. That might occur at any time, although the system was perhaps a proper one.

Mr. HUME WILLIAMS: That is just what happened, Sir.

His HONOUR (to Mr. Ferguson): You would only fine the manufacturer for particular acts?

Mr. FERGUSON said all cases of that kind would be dealt with by the conviction of the offenders.

Mr. HUME WILLIAMS said that the plaintiff and all the witnesses admitted that an average must be taken, and not a single specific act.

His HONOUR said specific offences could, of course, be dealt with; but under section 9 he had to look at the system of business adopted by the defendants. If the works required of the Company were carried out effectively, the case need not be brought before him again.

Mr. FERGUSON: What we want you to decide here, Sir, is that the process of burning sulphuretted hydrogen is not the best means to prevent nuisance arising.

Mr. HUME WILLIAMS: But why should you summon us? Had not you better choose, for the purpose of trying the question, somebody who is not complying with the directions of the Department?

His HONOUR said that, even if the Company had made confession of improper conduct in employing their present means of burning sulphuretted hydrogen, he would still be bound to hold that they must use the best practicable means by completing with all possible expedition the necessary works required by the Department. The parties could hardly expect to force upon him an academic discussion, however useful it might be for the purposes of legislation, or in dealing with similar cases. This case might be taken up to the House of Lords at great expense to the Company. His decision was that the Company were bound to adopt the best practicable means; and his present view was that, if they carried out the works prescribed by the Chief Inspector, they would have adopted a practical way of disposing of the present nuisance.

Mr. FERGUSON said the object of the Department was to obtain a condemnation of the defendants' present process.

Mr. HUME WILLIAMS suggested that they had better get this condemnation by prosecuting somebody who was not trying to satisfy them.

Mr. FERGUSON said the Company had been allowed to go on for several years before steps were taken to compel them to adopt the best practicable means.

His HONOUR thought the Chief Inspector (who had given his evidence straightforwardly) was right to be so patient. The Department were right in acting with a light hand at first; but giving time for consideration sometimes induced a spirit of carelessness or tediousness in compliance. People thought, when they had been allowed time for years, they might take a little longer.

Mr. FERGUSON said, unless the scrubber were put in, a nuisance would exist until the works were finished. The Company promised last December to erect it at once.

His HONOUR said the Company were now complying with section 9, and had undertaken to complete the work in four months. He should therefore hold that they were "using all practicable means."

Mr. HUME WILLIAMS said the scrubber was completed, and he could call evidence to show that the Company had been constructing these works since December last. He was really entitled to a decision in the Company's favour under the section.

His HONOUR suggested that to prove that the Company were proceeding with all convenient speed to adopt the best practicable means, would be all that was necessary.

Mr. FERGUSON remarked that they could have prevented the nuisance at once by putting up the scrubber as a temporary arrangement.

His HONOUR said the Chief Inspector was willing to allow them three months for completing the permanent works, which would give a profitable money return. This was a matter for consideration, of course. On the admitted facts, the Company were doing what they reasonably could to obey the Chief Inspector's directions; and he should hold that this was a compliance with section 9 of the Act.

Mr. FERGUSON urged that the summons had been taken out on account of the Company's delay.

His HONOUR said he knew nothing until to-day of the required works being in actual construction. There need be no feeling of triumph on either one side or the other.

Mr. FERGUSON said the limestone scrubber was a necessary temporary appliance; but, though promised, it had not been erected.

His HONOUR remarked that, if the Company carried out the works required to the satisfaction of the Department, this should satify them.

Mr. HUME WILLIAMS said, as a matter of fact, the tower was finished, and could be put in operation in a week. The Company were really using the best practicable means when the summons was issued.

His HONOUR pointed out that the Department would have the precedent, in any other cases, that one of the most powerful Gas Companies in London had yielded to their demands. If both parties wished him to go on with the hearing, he would do so; but his present view, on the facts, was that if the Company actually began in December last, and were now carrying out, works which would be the best practicable means of preventing the nuisance, the only way to deal with the case was to adjourn it, to enable the works to be completed.

Mr. HUME WILLIAMS said, if the case were to go on, he would show that at the date the summons was issued the Company were, to the knowledge of the Department, adopting the best means, and were therefore entitled to the judgment of the Court.

His HONOUR said, on Mr. Jones's statement that the limestone tower could be put in operation at once, he would adjourn the case; and if the works were found to be properly carried out, the parties need not come before him again.

Mr. FERGUSON asked if his Honour would dispose of the costs.

His HONOUR suggested that the parties should arrange about them between themselves.

Mr. HUME WILLIAMS pointed out that technically he was entitled to judgment.

His HONOUR said the parties might communicate with him on the question of costs if they desired, and he would say what should be done with regard to them.

The case was then adjourned for four months.

The Incandescent Gas-Light Company's Patents.

Several actions to restrain infringement of the patents of 1885 and 1886, belonging to the Incandescent Gas-Light Company, Limited, were disposed of by Mr. Justice Romer on Saturday. They came on as short causes, through default of defence, or owing to the defence having been struck out on account of non-compliance with the directions of the Court. Orders in the usual form were made against the American Incandescent Gas Lighting Company; Mundler; the National Incandescent Light Company; the Radiant Incandescent Gas-Light Company; and Loudon, trading as the Royal Incandescent Light Company.

Conviction of a Gas Inspector for Embezzlement.

At the Central Criminal Court last Thursday, Frederick William Jones, age 47, was charged before the Recorder with falsifying the books of The Gaslight and Coke Company, embezzling their money, and falsifying the accounts of the Workmen's Provident Fund. Prisoner pleaded "Guilty." Mr. C. Mathews, Mr. Bodkin, and Mr. Travers Humphreys prosecuted; Mr. Symmons defended the accused. Mr. Mathews said that, but for the fact that the prisoner gave himself up to justice, there would not have been a single mitigating circumstance in the case. He had been in the service of the Company as collector for twenty years, and was in receipt of a salary of £350 per annum, with a bonus of £50 as Secretary of the provident fund. He had grossly abused the confidence reposed in him. His defalcations, on the whole, amounted to upwards of £700. He absconded in October last with a sum of money. Mr. Symmons pointed out that the prisoner, through his misconduct, had sacrificed a situation worth £400 a year; and he explained that he had had a deal of domestic trouble. He was sentenced to 18 months' hard labour.

Reductions in Price.—On the recommendation of the Gas Committee, the Middleton Town Council have agreed to reduce the price of gas for public companies by 6d. per 1000 cubic feet, making it 2s. 3d.; for lighting purposes (ordinary) by 1d., making it 3s.; and for cooking and motive power by 2d., making it 2s. 8d. The Tideswell Gas Company have reduced the price of gas from 5s. 10d. to 5s. per 1000 cubic feet.

Newbury District Water Company.—The annual meeting of this Company was held last Tuesday—Mr. J. Bance (the Chairman of the Company) presiding. The Directors' report recorded a continuous and steady increase in the demand for water. There are now 2008 services laid on, against 1920 last year. The balance at the credit of the profit and loss account amounted to £1672; and the Directors recommended the payment of a dividend of 5½ per cent., free of income-tax. This would absorb £866. The report was adopted. It is proposed to construct a new reservoir on Wash Common, to enable the Company to keep pace with the building which was going on in the southern part of their district. Instructions have been given for the preparation of a scheme, with the approximate cost.

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS COMMISSIONERS.

A Question of Salaries—The Properties of Carburetted Water Gas—A Superannuation Scheme: The Annual Accounts.

At a Meeting of the Edinburgh and Leith Gas Commissioners held on Monday last week—Lord Provost Sir ANDREW M'DONALD in the chair—the Works Committee recommended that the Assistant-Engineers (Mr. Masterton at Edinburgh, Mr. Walker at Leith, and Mr. Vass at Portobello) should be designated Station Managers, subject to supervision by Mr. Herring; that Mr. Walker should be granted an honorarium of £100 in respect of his extra services before and after Mr. Linton's death; that as from the 1st of April last the salary of Mr. Masterton should be raised from £250 to £300; the salary of Mr. Walker from £200 to £300; and that of Mr. Vass from £215 to £225.

Mr. WATERSTON said he did not raise any question as to Mr. Walker getting the honorarium of £100; and he agreed that he and Mr. Masterton should be on an equality in the matter of salary; but he thought, when they remembered how difficult it was to get a rise of a penny for the working men, these big men should not be advanced so much as by £50 and £100. He moved that Mr. Walker's salary be increased by £50, and that Mr. Masterton's remain as it was.

Mr. MALLINSON, in seconding the motion, said he thought the salaries were sufficiently high, seeing that there was a qualified Chief Engineer.

Bailie KINLOCH ANDERSON moved the adoption of the recommendation of the Committee. He said Mr. Masterton was an expert in gas making, and was, besides, a civil engineer; and what might be said in respect of him might be said of Mr. Walker. He was a man of great ability; so much so that he was one of the short leet of five they recently selected to fill the vacancy of Chief Engineer. During the illness of Mr. Linton, Mr. Walker managed the works in Leith with great ability and economy. He had now greater responsibility than before—in fact, almost as much as Mr. Linton had—because Mr. Herring would not always be with him. Mr. Masterton had a very much larger responsibility than Mr. Walker, in the absence of Mr. Herring. But the Engineer would be more about the Edinburgh works; and the Committee thought it better to put them both on an equality in the matter of salary. In respect to Mr. Vass, the Commissioners came under obligation when they took over the Portobello Gas Company's concern, that none of the officials would be worse off than they were. Mr. Vass had certain perquisites besides his salary; and the Committee thought that a modest increase of £10 might be given him.

Bailie ROBERTSON seconded.

A division was taken, when 11 voted for the adoption of the recommendation, and only 3 against it.

Bailie KINLOCH ANDERSON submitted the following

REPORT BY MR. HERRING ON CARBURETTED WATER GAS.

My Lord Provost and Gentlemen,—From the correspondence which has appeared in the local Press, relative to the subject of water gas, I am of opinion that the public are labouring under a misapprehension, both as regards its poisonous properties, and also as to the Commissioners' intentions with regard to the proportion of carburetted water gas to be mixed with the coal gas for domestic consumption; and with a view to laying the simple facts before you, I have, subject to your consideration, prepared the following report:—

In the first place, let me clearly define the terms used, and their relative meanings—water gas, carburetted water gas, and coal gas.

Water gas is quite odourless, and burns with a non-luminous blue flame, and contains 47 to 49 per cent. of carbon monoxide gas.

Carburetted water gas has a very pungent odour; 1 part in 8000 of air being easily perceptible. It also has a high illuminating value, and contains from 27 to 29 per cent. of carbon monoxide gas.

Coal gas has a very pungent odour, and burns with a luminous flame, and to which carburetted water gas is in all respects similar; and it contains from 3 to 15 per cent. of carbon monoxide gas.

Water gas, pure and simple, is not used, excepting for heating purposes, where a large volume of heat is required in various manufacturing processes—such as heating gas-retorts, steel, glass, and other furnaces.

Carburetted water gas alone is very largely used in America for illuminating purposes; and it is also being largely employed in Great Britain to supplement the ordinary coal gas supplied.

Coal gas is universally used.

The distinctive difference between a mixture of carburetted water gas and coal gas, is to be found in its chemical composition, or, in other words, the proportion of the various gases which go to make up the whole; and the following comparisons serve to show this difference in gases of equal quality:—

Coal and Cannel Gas as at Present Supplied in Edinburgh.

	Mean, per Cent.
Hydrogen	37·18
Saturated hydrocarbons	40·26
Unsaturated hydrocarbons	9·37
Carbon monoxide	9·60
Carbon dioxide	0·00
Oxygen	0·20
Nitrogen	3·39

The Mixture Proposed to be Sent Out.

	Mean, per Cent.
Hydrogen	34·37
Saturated hydrocarbons	37·77
Unsaturated hydrocarbons	8·79
Carbon monoxide	14·49
Carbon dioxide	0·00
Oxygen	0·25
Nitrogen	4·33

From the above tables, it will be seen to closely resemble coal gas in composition, excepting in one important instance—namely, the percentage of carbon monoxide, which is slightly greater in the carburetted water gas mixture than in the coal gas of equal quality. Carbon monoxide is the most poisonous of the various gases constituting coal gas; and, while its action on the human system when inhaled in a pure state is well known, its action when diluted with other gases is distinctly different. A lengthened practical experience with water gas in all forms in America, goes to show that even pure water gas, containing up to 49 per cent. of carbon monoxide, is not a more fatal agent than coal gas; and though insensibility may have supervened, the men soon recover when exposed to the fresh air, and, moreover, do not experience the nauseating effects which are the characteristic results of ordinary coal-gas poisoning.

To judge from the correspondence which has appeared in the local Press, one would be led to conclude that the public are constantly in the presence of escaping gas, and that coal gas forms a constituent part of the air they breathe. This has only to be stated, to exhibit its own absurdity. Escaping gas is a very rare exception, rather than the rule; and, as Professor Crum Brown has pointed out in his report upon the utility of water gas, 1 part of gas in 8000 parts of air makes a very disagreeable odour, and would be instantly discovered thereby.

In America there are 296 gas-works supplying pure carburetted water gas, and 116 supplying a mixture of both coal and carburetted water gas—the two combined supplying gas to an aggregate population of 11,720,782 persons, and representing 75 per cent. of the total yearly make of gas in the United States. The British practice with regard to the supply of carburetted water gas differs essentially from the American practice, in that in only one instance has the distribution of pure carburetted water gas been practised by a gas company; and even this has been abandoned for a judicious mixture of carburetted water gas and gas as ordinarily produced. Carburetted water gas is in use in this country in the following towns: Belfast, Birkenhead, Birmingham, Blackburn, Brighton, Colchester, Hastings, Hornsey, London (several works), Lea Bridge, Liverpool, Manchester, Swansea, Stockport, Tottenham, and Winchester. Plant for its production is in course of erection at Brentford, Bridlington, Croydon, Crewe, Guildford, Middlesbrough, Plymouth, Southend, Swindon, Stockton-on-Tees, Taunton, and Edinburgh.

The statistics which have been quoted by some of the correspondents, relative to the fatal accidents by gas poisoning in America, must not only be viewed in the light of the enormous population supplied with water gas in that country, but it must also be borne in mind that it is a very common practice of suicides to deliberately retire to rest and leave the gas-tap open—a practice which in this country is fortunately seldom, if ever, resorted to. There is another important condition affecting this question. It is an admitted fact that less care is taken, or exercised, for the safety of the person in the United States than is the case in this country. In proof of this, one has only to refer to the statistics relating to the fatal accidents of any particular class in the United States, and compare them with similar statistics for our own country, to be convinced of its accuracy. It is common knowledge that there are far more fatal accidents in the United States, arising from the supply of electrical energy, road, car, and street accidents, and from other similar causes, than is the case in this country.

Carburetted water gas has been supplied in conjunction with coal gas to many English towns for a more or less lengthened period, and particularly in London, where it has been in use for the past six years, and where plant exists for the production of 20 million cubic feet per day. But, notwithstanding this, there is no evidence whatever to show that cases of fatal accidents, arising from inhaling illuminating gas, have been any more frequent in the towns named than was formerly the case. It is not, however, for a moment forgotten that one of the chief constituents of carburetted water gas is highly poisonous in its character when taken alone. But carburetted water gas need not necessarily be abandoned on this account.

Some classes of coal used in this country yield more of the poisonous gas—carbon monoxide—than is proposed to be supplied in the mixture of the two gases in many English towns.

From my investigations of the introduction of the subject to Edinburgh, it is clearly shown that the Gas Commissioners fully recognized the importance of the step they contemplated taking; and it appears much time was spent in deliberating the very question which now disturbs the public mind. But, before coming to any decision, they sought and obtained the eminent services of Professor Crum Brown, of the University of Edinburgh, to investigate and report to them upon the general advisability of supplying a portion of carburetted water gas with the coal and cannel gas that was then produced. This report, which bears the date of February, 1896, and was made public shortly afterwards, was of such a character as to warrant the Commissioners proceeding with the erection of the plant, with a view to its being ultimately used to supplement the present supply of coal and cannel gas. The whole of the deliberations of the Commissioners clearly show that this was the object constantly in view, and was one of the particular points Professor Crum Brown was asked to report upon. From the correspondence which has appeared, it is quite evident that the public are under the impression that water gas, pure and simple, or a mixture containing a large proportion of carburetted water gas is to be supplied,

Professor Crum Brown's investigations with regard to the relative properties of ordinary gas and a mixture of carburetted water gas therewith, forced him to the following conclusions:—

Professor Crum Brown's Conclusions.—"That even pure carburetted water gas in the air of a room becomes very offensive from its smell long before it is dangerous as a poison; and the results from its ordinary use may be practically neglected, as in the case of ordinary gas. The increased amount of carbon monoxide is therefore no real objection to the introduction of carburetted water gas for illuminating purposes in place of coal gas. A mixture of such carburetted water gas with the Edinburgh coal gas of the combination stated, would therefore contain, if mixed in the proportion of one of water gas to two of ordinary gas, not more than 17 or 18 per cent. of carbon monoxide. The products of combustion of carburetted water gas are exactly similar, but rather less in bulk, than the products of combustion in ordinary gas. It is apparent, therefore, that the reasons generally urged against the use of carburetted water gas are more imaginary than real."

The porportion of carburetted water gas which it is suggested should be mixed with the ordinary gas supplied from the Edinburgh works, is about 20 per cent., or 1 in 5, as against 1 in 3 said to be perfectly safe by Professor Lewes and Professor Crum Brown. This will give a product

containing 14 per cent. of carbon monoxide, or 3 to 4 per cent. under the proportion named in Professor Crum Brown's report. The proportion which might be safely added, and still keep within the limit which has been suggested by such authorities as Professor Lewes and others, is 37 per cent. of water gas and 63 per cent. of Edinburgh gas; resulting in a mixture containing 17 per cent. of carbon monoxide. Thus, it will be seen, an ample margin of safety is provided, when only 20 per cent. of carburetted water gas is to be added to the present supply.

Professor Vivian B. Lewes was recently engaged by the Birkenhead Corporation to report upon the supply of carburetted water gas at Birkenhead; and the following is reproduced from his report. Professor Lewes, from his investigations, arrives at the following conclusions:—

Professor Lewes's Conclusions.—"(1) That there is no danger in sending out as town supply a mixture of coal and cannel gas with carburetted water gas, provided that the carbon monoxide in the mixture does not exceed 17 per cent., which, with the two gases as at present made, would give a limit of 50 per cent. of water gas. (2) That mixtures containing 50 per cent. and under of carburetted water gas are, for all practical purposes, as good as cannel and coal gas; while for use in incandescent mantle lighting, they are superior."

The experimental data and other reasons upon which these conclusions were based, are fully set out in the report. The Birkenhead coal and cannel gas originally contained from 5·98 to 6 per cent. of carbon monoxide. The carburetted water gas, pure and simple, ranges from 28·57 to 29·78 per cent. of carbon monoxide. The mixture sent out for the town supply contained from 14·48 to 14·5 per cent. of carbon monoxide. The illuminating power is about 21·3 candles. The products of combustion yielded by coal and cannel gas and carburetted water gas are identical, and in each case consist of carbon dioxide and water vapour. The coal and cannel gas uses up a trace more atmospheric oxygen than the carburetted water gas, and yields rather more water vapour; so that the mixed gas would certainly have no more deleterious effect on the atmosphere and health than coal and cannel gas alone.

Mr. Herring then quoted at length from Professor Lewes's report to the Birkenhead Corporation given in the "JOURNAL" for April 20 (p. 893), and closed his report as follows:—

In conclusion, I may say it came to my knowledge, some two years ago, that the "Board of Trade" were contemplating placing restrictions upon the supply of carburetted water gas for public consumption. But the fact that nothing has yet transpired, and that they have not yet thought fit to issue any such restrictions or instructions regarding its manufacture or use, strongly point to the conclusion that their investigations have not justified them in interfering. The fact remains, that not one single instance of fatal accidents can be proved to have been caused by the supply of water gas in the towns named; and the public can rest assured that there is no more danger in its use as proposed in Edinburgh than is the case in other parts of Great Britain. In fact, some of the cannel coals which are produced in the neighbourhood contain more carbon monoxide than what it is proposed shall be the maximum limit of this gas in the town supply. And for the regular working of the process, I would propose that the gas be regularly tested day by day for the percentage of carbon monoxide it contains, the same as is done for the gaseous impurities which are eliminated in the process of purification.

June 11, 1897. (Signed) W. R. HERRING.

Bailie KINLOCH ANDERSON said the report was a very carefully prepared one, and dealt with the criticisms which they had had from the outside, to some extent. He should like very much that not only the members of the Commission should read the report, but that the Press should look at it. There had been letters in the newspapers from time to time referring to this gas—some of them being rather sceptical as to the desirability of adopting it. He thought there was a complete answer to these letters in the report by Mr. Herring; and if the Press representatives would kindly give it as much publicity as they gave the letters referring to the admixture, they would be only doing justice to the Commissioners. He was sure the Commissioners who went into the matter would not have sought this report if they had had the slightest suspicion on the subject. They were all careful of their own interests, and would not introduce into their houses anything which would be dangerous; but they were equally careful of the general interests of the public. If they had the least dread, they would not even now go forward and introduce carburetted water gas; but he was hopeful that the fears which existed in the minds of some, if fears there had been (for he had always had a suspicion that interested parties had had something to do with it, as probably the introduction of this plant might have an effect upon some particular qualities of coal) would be completely set at rest by this report.

The LORD PROVOST said he had read the report over and over again. It was very satisfactory that they had now a Chief Engineer who was able to produce such a report. He had no doubt it would be the means of instilling into the minds of the public views with regard to this gas which they would not otherwise have.

The report was adopted.

Mr. J. JAMIESON submitted an actuarial report upon the proposed scheme of superannuation for the officials and employees of the Commission, and moved that they accept the report and approve of the scheme as a suitable one for submission to a conference with the Corporation. The report proposed to give a right to the officials to retire at 65, and workmen at 60 years of age; and that they should all make a contribution to the fund, from their wages and salaries, of 3 per cent., the Commission to make a similar contribution. The report suggested that they might be able also to provide to some extent for incapacitated servants, and for those who had reached the age of 45 and who had been more than 15 years in their service. The contribution of the Commission would be something like £1800 a year. It was proposed that there should be ten years' contributions before the scheme came into operation; but there was an alternative proposal—that, by an additional payment by the Commission of £1000 per annum, for five years, they might begin superannuation after that period. The total sum of the contributions, at the end of five years, would be about £24,000. The Committee who had had charge of the subject recommended the adoption of the alternative proposal.

Mr. YOUNGER moved that the report be referred back to the Committee for consideration. He said it seemed to him to be in a somewhat crude state.

Mr. WALCOT seconded the proposition. He thought the matter required to be very carefully considered. It became a serious matter when they came to think of the amount which would be taken from the funds of the Commissioners. It came a little within £3000 a year. At the end of five years, it would amount to £14,865. He doubted whether they had the power to contribute this, or whether, even if they had the power, it would be wise to contribute it.

Mr. JAMIESON ultimately agreed to take the report back.

Mr. J. S. GIBB, the Treasurer, laid on the table the annual accounts of the Commissioners noticed last week, and the certificate of the Auditor in regard thereto.

Bailie KINLOCH ANDERSON said it would be observed that the accounts had been published by the Press and that there had been a leader in one newspaper criticizing their system of finance. He took this opportunity of assuring the public that the finances of the Commissioners were on a thoroughly sound principle. There was a suggestion made in the article that the production of gas was something like 1½d. or 2d. more per 1000 cubic feet than was charged for it. Well, so far back as 1893, when the introduction of electric light was spoken of, the Commissioners thought it would be wise to build up a fund, not knowing what the effect would be on their business; and the fund was increased from year to year, until it amounted to something like £40,000. They had found that instead of the electric light having any bad effect upon them, their increase had still gone on. In the past year it had been 92,707,000 cubic feet more than the year before. He thought they might feel assured that the electric light was not going to set aside the gas industry in Edinburgh; and, consequently, when they were making up the estimates for last year's supply, they fixed the price lower than cost. They considered that the fund which had been accumulated to meet the competition of the electric light belonged to the gas consumers; and they estimated to take something like £1500 out of it for the supply of gas, and to pay for certain other things, such as the new chimney. The position they were in had not come upon them at all unawares, or as a surprise. Residuals had been somewhat lower in price than was anticipated, which might also, to some extent, account for the deficit. They had, however, still about £24,000 of the fund; and possibly when they came to fix the price of gas again they might reduce it still further

MANCHESTER CORPORATION GAS SUPPLY.

Annual Report of the Gas Committee.

The report on the working of the Gas Department of the Manchester Corporation, with the accounts for the year ending March 31 last, has been issued by the Gas Committee; and we have, as usual, received a copy from the Superintendent (Mr. Charles Nickson). It will be presented to the Council to-morrow. The Committee record the progress of the undertaking as follows:—

Your Committee have pleasure in presenting to the City Council the statement and abstract of the accounts for the year ended March 31, 1897, and in supplying the usual particulars as to the manufacture and distribution of gas, and of the financial results of the year's working. Your Committee desire to report that the business of the Gas Department has continued prosperous, and the results of the year's working satisfactory.

The number of tons of coal and cannel carbonized, and quantity of gas and residual products made per ton carbonized, as compared with the previous year, is as follows:—

	Coal and Cannel Carbonized. Tons.	Gas per Ton. Cubic Feet.	Coke per Ton. Cwt.	Tar per Ton. Gallons.	Ammoniacal Liquor per Ton. Gallons (100's.)
1897	408,064	10,243	12·51	12·80	29·43
1896	375,514	10,025	12·53	12·44	27·89

The illuminating power of the gas sent from the works was equivalent to 19·16 standard sperm candles, as against 19·55 candles last year.

The increase in the consumption of gas for the year was 419,769,000 cubic feet, or 11·16 per cent., as compared with 79,503,000 cubic feet, or 2·16 per cent., in the previous year. The total output and quantity unaccounted for, compared with the previous year, is as follows:—

	Gas Sent Out from the Works. Cubic Feet.	Gas Unaccounted for. Cubic Feet.	Percentage of Loss.
1897	4,182,339,000	174,932,000	4·18
1896	3,762,570,000	116,560,000	3·10

The numbers of gas consumers on the 31st of March, 1896 and 1897, were respectively as follows:—

	Within the City.	Beyond the City.	Total.
1897	82,577	18,070	100,647
1896	70,546	16,696	87,242
Increase in 1897	12,031	1,374	13,405
Increase in 1896	4,201	752	4,953

The average consumption of gas per consumer in the city was 37,936 cubic feet, and beyond the city 27,932 cubic feet, as compared with 40,400 cubic feet and 26,711 cubic feet in the previous year.

The use of prepayment meters has greatly extended during the year, and has proved a great boon to the tenants of cottages. The number of these meters in use at the end of the financial year was 13,959, as compared with 3883 in the previous year—an increase of 10,076, of which increase 9574 have been fixed in the city and 502 in the out-townships. The quantity of gas consumed by these meters was 48,786,000 cubic feet—an increase of 26,016,000 cubic feet, or 114·25 per cent., on the previous year. The greater number of these meters have been in use for a short period only; and it is estimated that during the ensuing year the consumption by these means will be upwards of 100 million cubic feet.

The application of gas for trade and purposes other than lighting continues to increase. The number of gas fires, cookers, and other appliances in use was 9403, and the number of gas-engines 1275, as compared with 8019 and 1112 respectively for the year ended March 31, 1896. The quantity of gas used by these appliances is estimated at 250 million cubic feet; being an increase of 18·76 per cent.

The total amount of revenue was £552,816, as compared with £510,700 in 1896; being an increase of £42,116. The revenue was derived as follows:—

	1897.		1896.
Gas-rentals, &c., within the city . .	£386,797	..	£353,924
Do. beyond the city . .	78,053	..	69,816
Coke	37,604	..	40,634
Tar	31,650	..	27,411
Ammonia water	18,448	..	18,784
Sundry receipts	264	..	331
	£552,816	..	£510,700

The increase in the amount of revenue from gas-rentals arises from (1) the more general use of gas for cooking and heating, (2) the greater demand for gas for motive power, and (3) the large increase in the number of prepayment meters.

The amount paid for coal and cannel, including the cost of unloading, was £233,395. The cost of coal and cannel per ton carbonized was 11s. 5·27d., against 12s. 3·21d. for the previous year—a gain to the Committee of 9·94d. per ton, which on the total carbonization of 408,064 tons amounts to £16,900.

The whole of the works and plant have been kept in a state of thorough repair out of revenue.

The gross profit on the year's working was £119,223 1s. 10d. The sum of £33,153 0s. 4d. was paid for interest, and £17,745 10s. 3d. has been placed to the sinking fund (as required by the Acts of Parliament under which the money is borrowed). The net profit, therefore, amounted to £68,324 11s. 3d. Of this amount, £40,000 was paid over to the city fund; the balance, £28,324 11s. 3d., together with the sum of £9337 4s. 2d. transferred from the contingent fund account—making a total of £37,661 15s. 5d.—has been placed to the suspense account on account of the outlay on carburetted water-gas plant to date.

The expenditure on capital and renewals accounts was as follows:—

	Capital Account.		Renewals Account.
Gaythorn station . . .	£121 2 10	..	£712 9 4
Rochdale Road station .	1,775 4 6	..	1,604 6 8
Bradford Road station .	64,484 10 6	..	720 19 6
Droylsden station . . .	406 1 2	..	9 1 7
Street-mains	14,123 14 10	..	3,772 1 4
Service-pipes	5,545 5 0	..	5,545 5 0
Meters	29,445 7 11	..	8,331 0 6
Stoves	2,027 4 10	..	12 1 4
Stoves show-room, Deansgate	468 7 0		
Oil storage tanks, Ship Canal (Mode Wheel) .	4,645 0 8		
Property in Victoria Gardens and Mill Street, Bradford	6 1 0		
	£123,048 0 3		
Less value of hydraulic charging machinery, transferred from capital account (Gaythorn station) to renewals account Rochdale Road station)	500 0 0		
	£122,548 0 3	..	£20,707 5 3

The work at the Gaythorn station has proceeded satisfactorily, and a full supply of gas has been sent out. Early this year, the reconstruction of the No. 1 retort-house on the inclined retort system, under the direction of Mr. Stevenson, the Engineer, was commenced, and is expected to be in readiness for the ensuing winter.

In view of the important works contemplated during the current year to relieve the congested condition of the Rochdale Road station, the plant has been repaired or renewed only so far as has been found requisite. The "C" retort-house is being reconstructed on the regenerator system of settings. The whole of this work is well in hand, under the supervision of the Engineer. The retorts in "A" house will be demolished, and the site and building utilized for a meter and governor house and mechanics' and smiths' shops.

The large extensions which have been in progress during the past two or three years at the Bradford Road station are now practically completed. The gasholder of 7 million cubic feet capacity is completed, and has been filled with gas.* The whole of this work has been carried out with satisfaction; and the holder and tank are perfectly tight. This additional storage will be of great advantage in securing a full supply of gas in the future. The carburetted water-gas plant, with its compensating gasholder and oil-tank, is also completed. The River Medlock has been arched over for a length of 178 yards, and a further length of 200 yards is in progress. The space thus secured will be a useful "tip" for rubbish from the works for many years to come; and the land when filled up will prove of value for the extension of works or for building purposes.

The inclined retorts at the Droylsden station continue to give satisfaction, and are about to be extended. The experimental purifying plant is also producing good results, in reducing the carbonic acid and other impurities in the gas.

The work of the street-mains department consists chiefly in keeping the mains and services in thoroughly good condition—a work which, considering the difficulties to be contended with, has been efficiently done. There has also been a considerable increase in the services laid, owing to the great demand for prepayment meters. The total length of mains now laid is 1,319,390 yards, or 749½ miles and 270 yards.

The business done at the stoves show-room in Deansgate has been satisfactory, and gives evidence of an increasing demand for gas for cooking and heating purposes. The following is a summary of the year's transactions: Number of articles sold, 1218; new cookers and heaters purchased, 437; stoves issued on ordinary hire (including new stoves and re-issues), 1233; stoves issued on the hire-purchase system, 34; stoves cleaned and repaired, 830.

* This holder was described and illustrated in the "JOURNAL" for the 8th ult. (p. 1295).

BURY CORPORATION GAS SUPPLY.

An Explanation of the Lessened Profits.

At a Meeting of the Bury Town Council last Thursday, Alderman Byrom, Chairman of the Gas Committee, made his promised address as to the working of the Gas Department during the last financial year. He explained why the profit was only £213, as against £1969 in the preceding twelve months. He said that a reference to the annual report of the Gas Engineer (Mr. W. H. S. Gendall) would show that the increase in the sale of gas, as compared with 1896, had been 10½ million cubic feet, while the receipts only showed an advance by £439. This small increase was accounted for by the fact that the price of gas was reduced by 1d. per 1000 cubic feet at the beginning of the last financial year. To fairly compare the working of the two years, they ought to take the same price; and if this were done, the receipts for the past twelve months would be £1270 more, which would have been all profit. Another important factor in the profit making had been the condition of the residual products market. When the Committee fixed the price of gas twelve months ago, it was based upon the calculation that residuals would realize about the same amount; but the receipts under this head were £1998 less than in the previous year. These two items explained the reduced profit shown. Taking all the figures together, and supposing the conditions to be the same, they would have had a profit of £3817, instead of £213. He assured the Council that everything was done by the Gas Committee for the careful and efficient management of the gas-works, and said that while eight large boroughs which he could name only allowed 4½d. per 1000 cubic feet for interest and sinking fund, Bury allowed 8¾d. He reminded the Council that eleven years ago there was a great discussion as to the price of gas and the profits made from the department. The price in 1886 was 3s. 4d. per 1000 cubic feet; and the profit amounted to £9527. With the same price now, they would have had a profit of £15,000 on last year's working. In 1887, in consequence of the large profits made, the price of gas was lowered to 2s. 11d.; and with the same figure last year it would have been £10,166, as against £7000 in Jubilee year. This showed that the working of the department was very satisfactory. By using the greatest economy, and adopting labour-saving machinery, they reduced the cost in the manufacturing department by 2d. per 1000 cubic feet. Alderman Hall said they had splendid gas-works; the gas undertaking was a good trading concern. He thought, however, that they cut matters too fine; and he suggested that they ought to have a little more money in hand in case of emergency. Other members held that the price ought not to have been reduced last year. Mr. Wike said that, after the able statement made by Alderman Byrom, he thought the Council might with confidence leave the management of the gas-works in his and the Committee's hands. In the end, the minutes and report were confirmed. It should be added that the price of gas in Bury is now 2s. 2d. per 1000 cubic feet.

BIRMINGHAM CORPORATION WATER DEPARTMENT.

The Annual Accounts.

At the Meeting of the Birmingham City Council last Tuesday, the Water Committee presented their annual report and accounts, as noticed in the "JOURNAL" issued the same day.

Mr. BEALE, in moving their adoption, pointed out that, as compared with the previous year, the water-rents had increased from £186,000 to £199,000, or about 6½ per cent.; while the working expenses had decreased from £69,779 to £69,311. The charges on capital account necessarily increased year by year as the capital for the Welsh scheme was expended and interest accrued upon it. The gross profit, therefore, did not yield a corresponding amount of net profit. They had a net profit of £25,812, against £17,718 last year, and were able to add a very substantial sum to the "special water fund," which now amounted to £78,335. In regard to the revenue account, the pumping expenses had increased. If they distributed more water, the pumping expenses would be higher; but there was the additional reason that the increase in the city was now chiefly in the middle and higher districts. In the former every gallon of water supplied had to be pumped twice, and in the latter three times, in order to deliver it where it was required. The house-to-house inspection had resulted in an increase of revenue. While it might have caused some irritation here and there, its object was simply to make consumers pay for the water they used, instead of enjoying it at the cost of their neighbours. The consumption of water had been so far watched, and the house-to-house inspection had done its duty so well, that they were actually now supplying 2 gallons per head per day less than previously. In the present position of the undertaking, every economy that could be effected in consumption was valuable, as they did not want to spend any more money than they could help on works that would have to be abandoned. But for the saving in the consumption, the Committee would have had to supply 1,500,000 gallons more per day than was now being pumped. Referring to the progress of the Elan scheme, Mr. Beale mentioned with satisfaction that the Committee had been spending capital more slowly than was anticipated. This was due to their policy of beginning with the works that would occupy the longest time, and deferring those which would take less, with the object of getting all parts of the undertaking finished together. They thus delayed as far as possible the charges for interest and repayment.

The motion having been seconded,

Mr. LANE, offering some criticisms, remarked that he found there were some serious discrepancies between the actual figures shown in the report and the estimates presented to the Parliamentary Committee when the Water Bill was under consideration. It was estimated that the consumption of water would amount in 1891 to 15,500,000 gallons per day, and that by 1897 it would grow to 18,508,000 million gallons. The actual consumption in 1891 was 16,820,000 gallons; and in the year just ended, it was only 16,094,000 gallons. Nearly all the reports of the Committee had mentioned the saving of water that was being effected; but no information was given as to how the saving was accomplished. He admitted that the Committee were more accurate in the forecast of the gross revenue, which in the parliamentary tables was estimated for the year under review at £1,174,274; and it had actually amounted to

£1,174,426. He gave the Committee full credit for this; but he reminded them that there had been a rigid house-to-house inspection, which was not contemplated when the figures were presented to Parliament, and which had now come to an end. On the other hand, the working expenses had been £429,122, as against an estimate of £388,869. He was glad to see they were nearly half a million behind the anticipated capital expenditure; but the item which was of most interest was the "special water fund." The £78,335 in hand fell considerably short of the parliamentary estimate, though, thanks to the energy and good management which had been displayed, they were better off than they were last year.

Mr. BEALE, in reply, said the figures relating to the supply during 1891 and for some years afterwards, were estimated by the pumping returns, which, however, were found to be fallacious. Meters had been employed; and they knew exactly by the pumping returns and the water borrowed from one level for another what they were doing. He, however, was inclined to measure the growth of the department, not by the quantity of water pumped, but by the water paid for; and when they found the water-rents were going up steadily, without an increase in the charges, they must come to the conclusion that they were selling more water. The house-to-house inspection had been only an incidental matter. The effect of it naturally wore off; and the benefit of that was going downhill. The working expenses were largely in excess of the amounts put down in the estimate when the Water Bill was before Parliament; and this was due to the department having been somewhat starved for some years before the application to Parliament. They were now involved in a very large expenditure on engines at Aston and elsewhere, in order to keep them going for the next ten years. He also pointed out the mistake of assuming that because the calculations upon which the special fund was based were not borne out exactly, they were entirely wrong, and observed that they were based on certain averages. The corner might be turned one year or another; and if the revenue went on increasing, it was only a question of time when this would happen.

Increased Consumption of Gas in Bradford.—At a meeting of the Gas and Electricity Committee of the Bradford Corporation last Friday, the Engineer (Mr. W. Wood) reported that the amount of gas consumed in the city during the half year ended June 30 was 817,232,000 cubic feet, compared with 806,335,000 feet in the corresponding period of 1896, or an increase of 1·35 per cent. This advance has taken place in the last three months of the half year, and is attributed to the additional number of heating-stoves and gas-engines that have been adopted.

Water-Works Improvements at Hull.—The question of providing new pumping plant for the Springhead works has recently been occupying the attention of the Hull Corporation Water Committee. The Engineer (Mr. Bancroft) has submitted a report, stating that eight out of the twelve boilers were only capable of working at from 30 to 35 lbs. pressure; economy thus being out of the question. He recommended that new engines, pumps, and boilers should be provided; thus securing an ample supply of water for years to come. The estimated cost was £20,000; and the saving of coal which would be effected represented over £800 a year. It was decided to circulate the report among the members, and further consider it at a future meeting.

Gas Coal Contracts for Leeds.—The Leeds Corporation Gas Committee met last Friday to consider the tenders which have been received for the supply of coal required for the gas-works during the year commencing Oct. 1 next. The Committee require about 220,000 tons; this including 40,000 tons of cannel. The tenders sent in amounted in the aggregate to considerably over a million tons. It may be mentioned that 220,000 tons do not represent the quantity of coal annually consumed at the works. But the Committee have a considerable quantity in stock, and therefore do not need, at present, to purchase 300,000 tons, which, roughly speaking, is the quantity of coal used every year for gas-making in Leeds. The prices quoted in this year's tenders are on the whole slightly higher than was the case twelve months ago. In a few instances, the offers are the same; but in the majority of quotations, there are advances varying from 3d. to 6d. a ton.

The Accident to the Rope-Guided Holder at Middlesbrough.—A special private meeting of the Gas Committee of the Middlesbrough Corporation was held last Friday for the purpose of considering the report of Mr. H. Woodall, who, it will be remembered, was called in to examine the new rope-guided gasholder, to which the accident lately occurred. It is understood that Mr. Woodall did not attribute the accident to the sinking of the foundations, but to the breaking of one of the guide ropes, through which some of the brackets had been wrenched off, and, falling between the lifts, had jambed them. He suggested that, subject to certain slight alterations recommended by himself, the Committee should accept the offer of the Contractors (Messrs. Ashmore, Benson, Pease, and Co.) to put the holder in its original condition at their own risk, and keep it in working order for five years. The Committee inspected the holder; but they do not appear to have come to any determination.

Sales of Stock.—At the offices of the Newcastle and Gateshead Gas Company last Wednesday, Mr. Robert Mack offered for sale £20,000 of preference stock of the Newcastle and Gateshead Gas Company. The Auctioneer explained that the present was the first issue of preference stock created by the Company, and buyers would be entitled to 5 per cent. interest. For the last five years, the holders of ordinary shares in the Company had received the maximum dividend of 9¾ per cent. The stock was put up in lots of £100; the prices paid varying between £152 and £164. The whole amount was disposed of in twenty minutes. At Leeds last Tuesday, Messrs. Hollis and Webb sold, among other stock and shares, some new ordinary 7 per cent. stock in the Scarborough Gas Company at £178 per cent.; £150 of Harrogate "B" gas stock, at £355 per cent.; and £180 of Tadcaster and Wetherby gas stock at £190 per cent. The Directors of the Auckland Gas Company have lately accepted tenders for 501 £5 shares in the Company, at and above £14 10s.; the average price realized being £14 11s. 6d. Tenders were received for altogether 1678 shares. The tenderers at £14 10s. received 60 per cent. of the number they applied for; those above £14 10s. were allotted in full. Some new preference shares of £10 each in the New Swindon Gas Company have lately been sold at an average of £10 10s. each. Some £10 shares in the Woodbridge Gas Company were sold by auction last Thursday at an average of £22 12s. 6d. each.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have a large subject to tackle this week, in the doings of the Edinburgh and Leith Gas Commission, a report of whose meeting held on Monday, the 28th ult., appears in another column.* It is not often so much important business is disposed of by any gas-supplying body at one sitting. The chief subject of all was the report by Mr. W. R. Herring, the Engineer, on the qualities of carburetted water gas. This is the first opportunity Mr. Herring has had of showing himself since he came to Scotland; and I think everyone will agree that he is an acquisition to the ranks of Scotch gas managers. The chief characteristic of his report is its lucidity. No one can put two meanings upon any passage in it. Another feature is the way in which he stuck to the subject in hand. Confining himself strictly to the question remitted to him, he leaves no room for doubt that the use of carburetted water gas, as proposed for Edinburgh, will not be dangerous to the community. It may or may not be the best enricher of coal gas, but it is a safe one, may be said to be the gist of the report. Reading it thus, I agree with Mr. Herring. Whether our opinions would coincide further upon questions of enrichment, cannot be said. The subject of enrichment has been in the background in Scotland of late; it is once again about to come to the front. This Edinburgh installation of carburetted water-gas plant is a matter which will bring it forward; and there is another which I learn will be upon us soon, as to which I have information, but am awaiting confirmation of it before I give it out. Without being contradictory of my general and cordial assent to Mr. Herring's conclusions, there is one point on which, I may say, I do not yet see eye to eye with him. That is with reference to the layering of gas in holders. I am not convinced that carburetted water gas does not layer when it is mixed with coal gas at the inlet to the holder; neither am I convinced that ordinary coal gas does not. Has the matter ever been tested, in a practical manner, either with the one gas or the other? Whether it has or not, Mr. Herring puts as an argument against the layering of carburetted water gas what I am inclined to take as a matter of fact in support of the view that ordinary coal gas does layer to some extent. I have observed, and have often heard commented upon, the fact that the quality of the flame of a gas-burner frequently varies—that is to say, that sometimes one has a very much larger non-luminous portion of flame than is usually the case. How is this to be accounted for? Is it not by the fact that at times a particular district may be supplied with gas out of a holder which has stood for some days, and which, when it is nearly down, is discharging gas largely composed of hydrogen? Someone might investigate the question. It would make a good subject for a paper for one of the Associations.

To take the other matters which were before the Commissioners in the order in which they came up, the first for notice is that relating to the "Station Managers," as the gentlemen in charge of the various works are now to be termed. The change in nomenclature—whatever the name adopted—was bound to come; what is of importance is the subject of the salaries to be paid. I do not think anyone will consider that the gentlemen who have the arduous duties of managing the works are overpaid at the sums which have been fixed. But there are one or two members of the Commission whose position in public life is due to the success with which they have catered for the support of the working classes; and these members must do something to keep themselves in the good opinions of their constituents. I do not suppose any one of the three really objected to the increases of salary which were proposed; nor do I think that either of them would be prepared to undertake the same duties at the money offered.

The next subject was that of superannuation, regarding which I must say that I thoroughly agree with Mr. Younger that it was a crude scheme. Why postpone superannuation for ten, or even five years? In any scheme thus postponed equity could only be done by a provision that, if anyone left the Corporation employment of his own accord before the period of payment had begun, he would be entitled to get back his contributions, with interest, and that the representatives of anyone dying would be similarly treated. On the other hand, such a provision might wreck the scheme, because, say in the event of a strike, or even an epidemic, so many members, or their representatives, might have to be settled with, that there would be nothing left with which to carry on the scheme. There is a feature of work in gas undertakings which militates against a scheme of superannuation such as is proposed. What of the season men? It is the practice to take on men for the winter, and to discharge them in the spring. Would these men be required to contribute 3 per cent. of their earnings during the winter, knowing that they would have to go when the dark nights were ended, and leave part of the money they had earned behind them, for the benefit of others? I scarcely think they would submit to such terms. Suppose they were to get their money back on dismissal, the fund would be in a continual state of see-saw, such as would make it extremely difficult to work, very costly to administer, because of the heavy calculations involved, and altogether unsatisfactory to all concerned. At best, a scheme of superannuation appears to me to be little more than a tontine, under which the longest liver gets almost the whole of the benefit. Out of a hundred workmen employed in a gas-works, how many live to beyond sixty years of age? Not more than twenty, I should say; and of the twenty, only one or two probably would see more than seventy years. Is it worth while, then, to have all the trouble of collecting the pence every week, for the benefit of a very, very small handful of men? I think not. Further, is it good finance to place all the grades in the service upon the same footing in the matter of contributions, when they are not to be on the same conditions of retirement? Relatively, the one class must be contributing more than the other, which is not just. The task Mr. Jameson has taken upon himself seems to be a hopeless one. He would do better to drop it altogether, and to apply his energies rather to fostering and encouraging habits of thrift and benevolent societies among the men—leaving the officials, who have salaries which enable them to take advantage of life assurance, to see after themselves.

The annual accounts were laid on the table by Mr. Gibb, the Treasurer, along with the docket of the Auditor, which is the first time

* See page 57.

that the two have come together. The accounts were referred to last week. I only now deal with the defence, by Bailie Kinloch Anderson, of the system of finance adopted by the Commissioners. He took advantage of the occasion to make an explanation, in reply to the strictures of the "Scotsman," which I mentioned last week. His defence was quite a satisfactory vindication of the Commissioners; but it did not satisfy the Editor of the "Scotsman," who returned to the charge next day, and, in effect, libelled the Commissioners with dishonesty. The fund which the Commissioners had built up, he said, does not belong to the gas consumers, because some were consumers when it was raised who are not so now. Such nonsense. As well might it be said that the National Debt is not the debt of this generation, because most of it was incurred before the people now alive were born. Then it is said that "there is only one proper way of managing such an affair, and that is to take care that the price charged for the article produced leaves a margin of profit over the cost of production. This principle has been violated by the Gas Commissioners." Now this is an armchair principle, and nothing more. It is not the principle of the Act of Parliament which directs the action of the Commissioners. Under it, they are bound to fix the price of gas as nearly as it may be estimated, so as to "meet the costs and charges of, and incident to, the manufacture and distribution of gas, and the sale of residual products, the annuities, interest on borrowed money, expenses of management," &c.; and any deficiency or surplus is to be carried forward. This is what the Commissioners did. They carried forward a surplus year by year; and now they want a deficit to use up this surplus. How a surplus could be got rid of except by a deficit, it puzzles me to know. But there is no good in labouring the question. It is not the Commissioners' system of finance which is attacked; there is something more. If Bailie Kinloch Anderson will put these two editorials alongside a letter to the Editor which appeared subsequently, he will see that the party or parties writing are well posted up in what they are writing about; and, considering the distorted view they are taking, the conclusion must be come to that the work is that of some one either inside or closely connected with the Commmission. For what object? Somebody is not to have the support of the "Scotsman" in whatever municipal developments may take place during the next few months.

The last subject I shall mention is that of the Edinburgh Gas-Works chimney. What is the matter with the new chimney? I heard that it was not giving satisfaction, but placed little credit on the information. Now, it appears, the old one is to be lowered in height, and kept in use; and I observe that the Commissioners are advertising for tenders for the construction of a new flue, and for the underpinning of columns in the Edinburgh works. The troubles of the Commissioners in connection with their Edinburgh works have been so great that they must surely now be convinced that it would have been to their interest to have gone to a new site long ago.

The contracts for gas coals recently entered into by the Glasgow Gas Commissioners have been made at such prices as will give a tone to the purchases yet to be made throughout Scotland. They may be regarded as being for the whole of the year 1897-8, or practically so; for in the year 1895-6 the consumption of coal amounted to 516,351 tons. The returns for the year, which was finished on the 31st of May last, have not yet been made public. This year's purchases amount to upwards of 480,000 tons; and they amount to well-nigh fifty different kinds—from the rich cannel of Arniston in East Lothian, and Cairntable in Ayrshire, to the splint of Gilbertfield (Hamilton). The price ranges from 6s. up to 18s. per ton. In respect of the quantities contracted for, there is a great variety. In two cases the purchase amounts to only 1000 tons; whereas in others there are orders for 10,000 tons (nine or ten lots); some seven lots of 15,000 tons each; four lots of 20,000 tons each; one lot of 25,000 tons; a 30,000 ton lot of Cairntable (centre); and, lastly, a lot of 60,000 tons of Lanemark, Ayrshire, which is, in all probability, the biggest order ever given out to one firm by the Glasgow Contracts Sub-Committee of the Gas Trust. The famous "Virtuewell," of the Lanarkshire coalfield, and the not less famous "Kiltongue" coal, from the Middle Ward of the county, are abundantly represented in the orders given out; while the "pugs" of three or four collieries are also present at prices ranging from 6s. 6d. to 6s. 9d. per ton. There are also two well-known coking gas coals among the orders that have been placed with colliery firms. As regards the counties from which the coals are to be obtained, there is also much variety. Not only do they come from East Lothian and South Ayrshire, but Leven in Fifeshire is put under demand to the extent of 15,000 tons, while Linlithgowshire is to supply 1000 tons of its plesio-Boghead coal. The rule, however, is that the Middle Ward of Lanarkshire is to be the chief source of supply. Lastly, the average price is said to be about 9s. 2d. per ton; while the total cost is put down at about £220,000, or fully £18,000 under the total cost price in 1895-6, when the purchases amounted to 516,351 tons.

The annual meeting of the Hawick Gaslight Company was held yesterday. The Chairman intimated that they had sold 3,300,000 cubic feet more gas than in the preceding twelve months, which was the best sign of the success of the year's trading. In consequence of the great and increasing demand for gas, they were enlarging the retort-bench, and arranged for the erection of an additional engine and exhauster, and a new station meter. Oil gas had not taken the place it was expected to do; neither had the carburetted water gas introduced by the Edinburgh and Leith Gas Commissioners. Of course, the Chairman made a slip with regard to Edinburgh, where carburetted water gas is not yet being made; and there are people who believe that he was wrong also with regard to oil gas. But the gentleman is entitled to his opinion. The profits for the past year were reported to have been £2321, which was £610 more than in the preceding year. A dividend at the rate of 10 per cent. was declared; and the price of gas was reduced from 3s. 6½d. to 3s. 2d. per 1000 cubic feet.

The Dundee Corporation Bill, now denuded of all its provisions except those relating to borrowing powers in connection with the gas and electricity departments, passed the House of Commons Committee on Tuesday, as an unopposed measure, and has since been reported to the House for third reading.

The Broughty Ferry Gas Commissioners held their annual excursion last Wednesday. They took train to Edinburgh, whence they drove to Roslin. After viewing the famous Chapel there, and the ruins of the Castle, they walked down the romantic glen to Hawthornden House, at one time the residence of the poet Drummond. Here their conveyances

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 33).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	105—103*	..	4 12 8
200,000	10	27 May	7	Belgrano (B. Ayres), Limited	9¾—10¼	..	6 13 4
100,000	Stck.	29 June	5	Do. 5 p. c. Deb. Stk	103—106*	+1¾	4 14 4
200,000	5	27 May	6½	Bombay, Limited	6½—7	..	4 5 9
40,000	5	,,	6½	Do. New, £4 paid	5¼—5¾	..	4 10 7
380 000	Stck.	26 Feb.	12	Brentford Consolidated	297—302	..	3 19 7
240,000	,,	,,	9	Do. New	223—228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	145—150	..	3 6 8
159.375	,,	11 June	4	Do. 4 p. c. Deb. Stock.	130—134	..	2 19 9
220,000	Stck.	26 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	201—206	+4	4 2 6
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130—135	..	3 14 1
420,000	20	26 Mar.	11½	British	56—57	..	3 18 11
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23—25	..	4 12 0
71.000	10	,,	8½	Do. 7 p. c.	18—20	..	4 5 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	10—10½	..	5 14 3
200,000	100	1 July	6	Do. 6 p. c. Deb.	100—102*	+2	5 17 8
150,000	20	26 Feb.	8½	Cagliari, Limited	30—32	..	5 3 1
100,000	10	11 June	8	Cape Town & District, Ltd	16½—17½	..	4 11 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	342—347	..	3 17 9
165,000	,,	,,	10½	Do. New do.	257—262	..	4 0 1
165,000	,,	11 June	4½	Do. 4½ p. c. Deb. do.	150—155	..	2 18 0
800,000	Stck.	11 June	13	Continental Union, Limited.	250—255	..	5 1 11
200,000	,,	,,	10	Do. 7 p. c. Pref.	212—217	..	4 12 2
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.	317—322	..	4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255—260	..	4 4 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	139—142	..	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 11
5,896,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	317—322	+5	3 19 3
100,000	,,	,,	4	Do. B, 4 p. c. max.	112—117	..	3 8 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	312—317	..	3 3 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
63,000	,,	,,	7½	Do. G, 7½ p. c. do.	220—225	..	3 6 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	312—317	..	3 3 1
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.,	138—141	..	2 13 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155	..	2 13 0
908,000	,,	,,	6	Do. 6 p. c. do.	205—210	..	2 17 1
70,000	10	13 May	6	Hongkong & China, Limited	13½—14½	+½	4 2 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	13 May	10	Imperial Continental	217—222	+2	4 10 1
376 400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk	104—107	..	3 5 5
75,000	5	29 June	6	Malta & Mediterranean, Ltd.	5½—6*	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	112—114	..	4 7 8
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107—109	..	4 2 7
541,920	20	11 June	5	Monte Video, Limited	14—15	..	6 13 4
150,000	5	27 May	8	Oriental, Limited	8¼—8¾	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7¼—7½	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1¾—2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5—5½	..	6 7 3
420,000	100	3 May	6	People's Gas } 1st Mtg. Bds.	104—109	..	5 10 1
500,000	100	1 June	6	of Chicago } and Do.	105—110	..	5 9 1
250,000	10	27 May	10	San Paulo, Limited	14½—15½	..	6 9 0
5,475.000	Stck.	26 Feb.	5½	South Metrop., 4 p.c. Ord.	142—145	+1	3 12 5
1,416,667	,,	—	3	Do. 3 p.c. Deb. Stk.	107—110	..	2 14 7
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275—285	..	4 0 10
60,000	,,	,,	8½	Do. B	190—200	..	4 5 0
182,380	10	27 May	10	Tuscan, Limited	13½—14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	100—103*	+½	4 17 1
				WATER COMPANIES.			
746,159	Stck.	29 June	10½	Chelsea, Ordinary	328—333*	+1½	3 3 0
150,000	,,	,,	5	Do. 5 p. c. Pref.	157—160*	+½	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	157—160*	+½	2 16 3
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 0
1,720,563	Stck.	9 Apl.	7	East London, Ordinary	221—225	..	3 2 9
654,740	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	163—166*	..	2 14 3
390,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106—108*	+½	2 15 7
700,000	50	11 June	7½	Grand Junction, 10 p.c. max.	118—123	+1	3 1 0
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	347—352	+2	3 8 3
160,000	,,	,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	280—285*	+1½	3 8 5
406,200	100	,,	7½	Do. 7½ p. c. max.	217—222*	+½	3 7 7
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares.	430—435	+2	2 19 8
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152—155	..	2 11 7
902,300	Stck.	29 June	5	S'thwk & V'xhall, Ordinary	160—163*	+1½	3 1 3
126,500	100	,,	5	Do. Do. 7½ p. c. Max.	150—153*	+1½	3 5 4
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	173—176*	+½	2 16 2
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148	..	2 14 2
1,155,066	Stck.	11 June	10	West Middlesex	310—315	..	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	162—167	..	2 13 11

*Ex div.

met them, and then the return drive to Edinburgh was begun. On the previous evening, the executive of the Broughty Ferry Ratepayers' Association—one of those detestable, self-elected bodies which are to be found in some towns, whose action, in my experience, tends simply to pester legally elected representatives, and to hamper them in the execution of their duties—met, and in characteristic fashion, fell to criticizing the doings of the Commissioners in connection with the extension of the gas-works and the excursion of the next day. I suspect the chatter of the Association did not mar the enjoyment of the Commissioners on Wednesday; and the Commissioners will be wise men if they allow it as little to influence them in the policy they are adopting to bring the gas-works up to a condition to meet the now greatly increased demand which is made upon them.

I have received a fuller statement regarding the Bothwell and Uddingston Gas Company, of which Mr. L. Hislop is Manager, than I was able to publish last week. During the year, there was expended upon new purifiers and purifier-house, £2736. The quantity of gas sold amounted to 31,121,800 cubic feet—an increase of 4,500,000 cubic feet upon the previous year. The leakage was about 7 per cent. The quantity of coal carbonized was 3463 tons, as compared with 3261 tons; showing better results from the improved plant. The revenue from gas was £5174; and from residual products, £886. The total revenue was £6324. The total expenditure was £4330; leaving a balance of profit of £1994. Of the total expenditure, coal cost £1515; lime, £72; repairs, maintenance, and stores, £824; carriage and cartage, £230; and wages and salaries, £853. The Directors set aside £375 for depreciation, in addition to paying the dividend, as stated last week, of 10 per cent.

The Kelso Gas Company held their annual meeting on Wednesday, and declared a dividend at the rate of 10 per cent. for the past year. They also recognized the abilities of their Manager (Mr. W. B. M'Lusky) by advancing his salary by £25. During the past year, Mr. M'Lusky has been busy with the erection of a new station meter of three times the capacity of the old one, and of a new rotary washer and scrubber. The price of gas was reduced from 4s. 7d. to 4s. 2d. per 1000 cubic feet.

The report by the Water Committee of the Corporation of Glasgow for the past year is altogether a record of progress. The Lock Katrine water-works were the pioneers of their sort. The Corporation have had an unbroken success in the management of the works; and the history of the undertaking has been as pronounced as that of any corporation water supply. The Glasgow scheme was an original one. It has had many imitators; but none have surpassed it, either in boldness of conception or in soundness of management. Without its magnificent water supply, Glasgow would not to-day occupy its proud commercial position. It is significant, but true, that many places suffer from a high charge for water for manufacturing purposes; and that few municipalities have the common-sense or the courage to lower their charges, and so encourage trade in their midst. The report of the Committee states that, for the year ending May 31, the revenue amounted to £201,226, which, with the credit balance from last year of £25,311, made a total of £226,537. The total expenditure was £148,961; leaving a balance of £77,575, of which £36,789 was carried to sinking fund, and £40,786 to next year's account. The increase in the revenue as compared with the previous year amounted to £11,512; and in the expenditure, to £1101. The amount expended for new works and added to capital account, was £112,106. The total capital expended on new works now being constructed amounts to £1,302,480. The balance of unexhausted borrowing powers amounts to £165,901. The sinking funds set apart for, and being applied to, the redemption of annuities and in repayment of monies borrowed in terms of the Corporation's Acts of Parliament, but exclusive of the reduced mortgage account, now amount to £820,361. The works have been maintained in an efficient state during the past twelve months. The old aqueduct from Loch Katrine is in some places in want of being overhauled; but much of this cannot be done until the new aqueduct is further advanced. Of the 23½ miles of which the new aqueduct consists, 19 miles are completed and in working order. The remaining 4½ miles consist of the Loch Katrine tunnel and the Black Rig tunnel. The latter will take about nine months to finish the lining; and the Loch Katrine tunnel, including the new inlet basin, will probably take three years to complete. The new mains from Craigmaddie to the city are finished as far as Springburn; and the continuation of these mains into the city is now in hand. The works for raising the level of Loch Katrine the 5 feet authorized by the Act of 1885, will probably be commenced during the autumn, and should be completed in about two years.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 3.

Sulphate of Ammonia.—There has been no fresh feature during the week; the market being quiet, but steady, at £7 8s. 9d. per ton f.o.b. Leith, £7 10s. per ton f.o.b. Hull, £7 12s. 6d. per ton f.o.b. Liverpool. The demand continues moderate; but it is sufficient to absorb the summer production. Inquiry is mostly in the forward position; and there would be large buyers if on the level of prompt prices. German producers show most readiness to contract ahead. Speculators are less keen about business, pending the result of negotiations for a reduction of the output of nitrate of soda over the next twelve months; and home producers for the most part refuse to quote, except at prohibitive prices.

Nitrate of Soda is slightly firmer on spot; the quotation being again 7s. 6d. per cwt. for ordinary quality. As regards the future, much depends upon whether producers can agree to reduce. So far, they have not been able to arrive at an agreement.

LONDON, *July* 3.

Tar Products.—There is not much satisfaction to producers in the present aspect and position of this market. It is true benzols are rather firmer; but whether the increased price will be maintained, it is difficult to say. A better demand for aniline is reported; but certainly not of sufficient dimensions to influence the value of benzols. Carbolic acid is weak, with a tendency to lower prices—the reflection of the very poor demand for crystals, which have also fallen ¼d. per lb. For pitch there is still a dull outlook; and as it forms so large a percentage of tar,

CARBURETED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

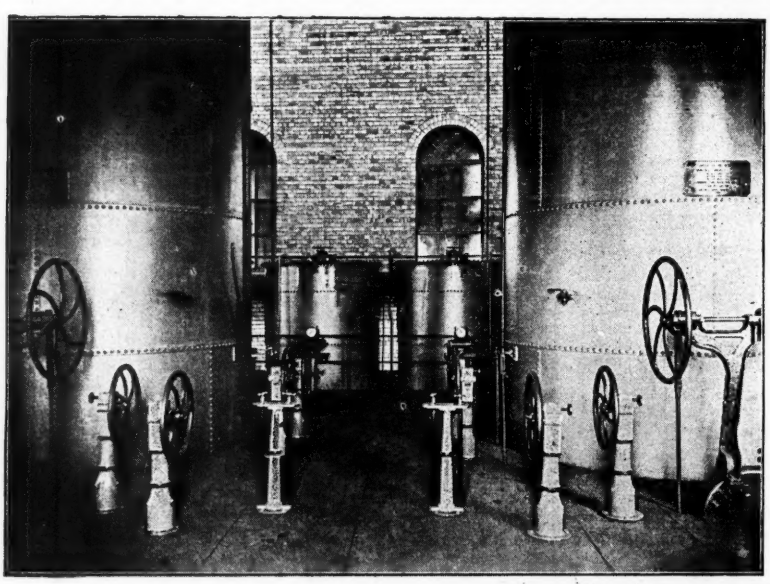
W. H. PEARSON, President.
W. H. PEARSON, Junr., Vice-President.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.I.M.E., Chief Engineer.

London Offices: SUFFOLK HOUSE, LAURENCE POUNTNEY HILL, E.C.
American Offices: TORONTO.

TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETED WATER-GAS ENGINEERS.

THE M.-W.-P. PLANT is designed to use the Heaviest as well as the Lightest Grade of Oil.



RESULTS PROVE EFFICIENCY.

Working Floor of Generator House. One Quarter Section of Birmingham Plant, Windsor Street Station.

the serious fall in its price is a grave matter for distillers who have bought tar on last year's pitch values. Solvent naphtha is firm; and there is a better inquiry for toluol. Anthracene is sick and unsaleable; while creosote and tar oils are in fair demand at improving rates.

Prices may be taken as follows: Tar, 15s. 6d. to 18s. 6d. Pitch, 18s. to 21s. 6d. Benzol, 90's, 2s.; 50's, 1s. 2d. Toluol, 2s. 3d. Solvent naphtha, 1s. 6½d. Crude, 30 per cent., naphtha, 11d. Creosote, 1¾d.; liquid, 2¼d. Heavy oils, 36s. Carbolic acid, 60's, 1s. 10½d. Pressed naphthalene, 60s. Creosote salts, 25s. Anthracene, nominal, "A," 7d.; "B," 5d.

Sulphate of Ammonia continues fairly steady, with considerable business going on. The outlook, however, is somewhat disappointing, as makers had hoped, with the smaller production, that prices would have advanced. The buying is mostly of a hand-to-mouth character; and a good deal of uncertainty exists as to future values. Transactions during the week have taken place at an average price of £7 8s. 9d. at all ports, less 3½ per cent.

COAL TRADE REPORTS.

From Our Own Correspondent.

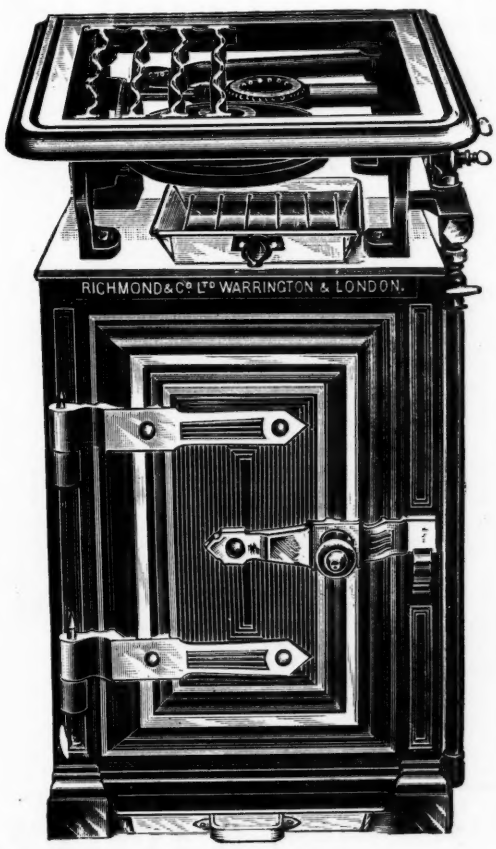
Lancashire Coal Trade.—A large proportion of the important contracts for gas coal have now been settled; and the basis of prices has been, as I have previously anticipated, practically the same as those ruling last year. In very few cases has any advance been secured, though colliery proprietors early in the year were quoting about 6d. above last season's contract prices. The average basis may be given at about 6s. 3d. to 6s. 6d. per ton at the pit, according to quality, for ordinary Wigan four-feet gas coal; and from 6s. 9d. up to 7s. 3d. for screened Arley gas coal. There have been some further contracts placed for locomotive fuel; and these, notwithstanding the strong determination which colliery proprietors expressed to hold out for an advance, have also been accepted at the low figures ruling last year—averaging about 5s. 9d. per ton at the pit for good qualities of locomotive fuel. With regard to general trade, all descriptions of round coal are in very slow demand; and notwithstanding the recent holiday stoppages, stocks are accumulating in considerable quantities, and many of the pits have been put on short time. Steam and forge coals are plentiful, and difficult to move, with prices low. Engine fuel meets with a fairly active demand, and with supplies not excessive, prices are steady at late rates. At the pit mouth, best Wigan Arley averages 9s. 6d. to 10s. per ton; Pemberton four-feet and seconds Arley, 8s. to 8s. 6d.; steam and forge coals, 5s. 9d. to 6s. 3d.; and engine fuel, 4s. 6d. to 5s. for best sorts, 3s. 9d. to 4s. 3d. for medium, and 3s. 3d. to 3s. 6d. for common slack. The shipping trade is only moderate, with prices easier; ordinary steam coals being readily obtainable at about 7s. 6d. per ton, with better qualities quoted at 7s. 9d. to 8s. delivered at Mersey ports.

Northern Coal Trade—The demand has been generally good for the past week; and with an output that is not quite at its best, coal is still rather scarce, and the prices have been generally firmly maintained. The tendency, too, of prices is rather upwards, as the mines are pressing for advances, and legislation seems likely to put heavier burdens on the coal owner. Best Northumbrian steam coal is firm at 8s. 6d. per ton f.o.b.; second-class steam, about 8s.; and steam smalls, 3s. 6d. In the gas coal trade, there is not yet much expansion in the orders, though the consumption is increasing, and the exports are fully an average. Prices for best Durham gas coals vary from 7s. to 7s. 6d. per ton f.o.b.; and some of the leading producers seem to believe that higher rates are probable a little later in the year, when the demand becomes fuller, and when it is thought likely that some advance in wages may have to be made. The effect of the Accidents Compensation Bill must also add to the cost of producing coal. Gas coke shows no alteration this week, either in price or in the demand.

Scotch Coal Trade.—Coal merchants continue to have their hands full of business, many having current orders which will keep them going for several weeks. Steam and ell are both in good demand. Splint is plentiful; and the price seems to be hardening. Main is unchanged. The prices quoted are: Main, 6s. 3d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 6d.; and splint, 6s. 6d. to 7s. The shipments for the week amounted to 161,941 tons—an increase over the preceding week of 15,732 tons, but a decrease on the corresponding week of last year of 11,930 tons. For the year to date, the shipments have been 3,638,987 tons—an increase upon the same period of last year of 130,029 tons.

Increase of Price by the South Metropolitan Gas Company.—The following notice has been issued by the Directors of the South Metropolitan Gas Company in certain of the parishes supplied by them: "In consequence of the large increase in the assessment of the Company's mains in the parish, the Directors regret to give notice that the price of gas will be raised from 2s. 3d. to 2s. 4d. per 1000 feet from the quarterly index-taking at Midsummer."

The Public Lighting of Leeds.—During the next twelve months, important changes are likely to be made in the system of lighting the thoroughfares of Leeds. From the top of Briggate as far as the Great Northern Station in Wellington Street, the present gas-lamps are to be removed, and the light supplied by forty arc lamps. These are to be placed on the top of the centre poles and side brackets to be used in connection with the overhead electrical tramway system. During the last three weeks, the experiment has been tried of lighting Park Row, from the Cathedral to the end of Bond Street, with incandescent lights; and it is probable that at an early date the Lamp Committee will take into consideration the advisability of introducing this form of illumination in several of the main thoroughfares. There are at present about 11,000 gas-lamps in the city; the gas consumed in them last year costing the Lamp Committee £16,678. Attending to the lamps gives employment to 103 lamplighters, whose aggregate wages amounted to £6036. Adding to these two items the cost of new lamps, and the expenditure upon repairs, the total sum spent by the Lamp Committee last year was rather more than £25,000, or an average of about £2 5s. per lamp.



RICHMOND & CO., LTD.

WARRINGTON, STRATFORD, & LONDON.

1897 New Pattern

KING-OF-THE-SLOTS

"K-O-S."

No. 128 - - - - - 65/-

SPLENDID VALUE.

SPECIALLY BUILT FOR PENNY-IN-THE-SLOT METERS.

TAPS AT FRONT OR SIDE SAME PRICE.

SUPPLIED WITH WHITE ENAMELLED CROWN PLATE FREE OF CHARGE.

SEE OUR STAND (No. 59) AT THE ROYAL AGRICULTURAL SHOW, MANCHESTER.
1250 SQUARE FEET OF EXHIBITS.

English Incandescent Gas Share Company, Limited.—At the second annual general meeting of this Company held on Friday, the report and accounts (noticed in the "JOURNAL" last week) were adopted; and a final dividend of 10 per cent., free of income-tax, was declared. A resolution was passed sanctioning a scheme of amalgamation with the Incandescent Gas-Light Company, Limited; and the Directors will proceed to carry it into effect.

Gas Devices for Illuminations.—"It has been noticeable, and is noteworthy, in connection with the general Jubilee illuminations," says "The Ironmonger," "that gas has had a marked preference over the electric light, and that where gas has not been the agent employed, oil-lamps have been used. It has been found by experience that gas gives better scintillating effects than electricity, hence the preference for the former displayed by firms whose experience in these things is necessarily wide and great. In some instances, combinations of gas and electricity have produced highly pleasing effects; but it has to be admitted, even by ardent friends of the latter, that gas, on the whole, is the better illuminant for the purpose."

Electric Lighting Extensions at Leicester.—The electric light has met in Leicester with success which the most sanguine member of the Corporation Gas and Electric Light Committee has not anticipated. For saying this we have the authority of the Chairman (Alderman Lennard); and the statement is borne out by a report of the Engineer (Mr. Alfred Colson). In this it is stated that last winter the load reached 90 per cent. of the capacity of the station; and Mr. Colson anticipates that the demand next winter will exceed the present capacity to supply. He has therefore suggested that extensions should be made at an estimated cost of £30,193; and at a meeting of the Town Council last Tuesday, his proposals were adopted, as well as a recommendation by the Committee that application should be made to the Local Government Board for sanction to a loan of £33,719—the difference being made up of expenditure already incurred beyond the amount previously sanctioned by the Board. The following extract from a report of the speech of Alderman Lennard in dealing with the above matters, furnishes food for reflection on the part of electrical engineers in this country: The Committee propose that four 350 kilowatt inductor alternators should be erected in place of the present three 200 kilowatt and one 75 kilowatt alternators; and the only question which they had to settle was as to the type of dynamos which would have to be laid down. Inquiries had been made on the Continent by a deputation who visited various places for the purpose of getting information on the different kinds of machines. He was quite aware that some people might think the Committee ought not to go outside this country for machines if they could get them made at home; but in the present case, the Committee were sure that the machines which they would get made for them abroad would do much better than anything which they could have got in this country. ("Shame.") He admitted that it was a shame, but thought the Committee were performing a national duty in doing what they were; for in bringing such a machine into the country, it could not fail to act as a technical instructor for their own engineers and electricians.

New Gas-Works for Bramham (Yorks.).—The Directors of the Bramham Gas Company have unanimously decided to construct new works of a more modern type, in accordance with the report and designs submitted to them by their Consulting Engineer (Mr. Matt. Dunn, M.Inst.Mech.E., the Engineer and Manager of the Selby Gas-Works). An excellent site has been purchased for the erection of the works; and the work is to be proceeded with immediately, under the superintendence and to the satisfaction of Mr. Dunn.

The Price of Gas in Manchester Out-Districts.—At the recent interview between the Manchester Corporation Gas Committee and representatives of local authorities outside the city, but within the area of the Manchester gas supply, it was announced by Alderman Gibson that, subject to the approval of the City Council, the Committee had decided to reduce the charge for gas to residents in the district in question from 2s. 9d. to 2s. 6d. for those on the city side of the Mersey, and from 3s. 3d. to 3s. for those on the other side. This decision still left the residents of Cheadle, Cheadle Hulme, Northenden, and Gatley with a grievance; and the Committee have since decided to recommend that from the September quarter the charge to all the out-districts should be 2s. 6d. per 1000 cubic feet, and that meter-rents should be abolished. Assuming that no increase in consumption of gas takes place, as a consequence of this decision, these concessions will mean a loss of something like £9000 a year to the Corporation.

East Surrey Water Company.—The annual general meeting of this Company was held on Saturday, the 26th ult., at Redhill—Sir F. Bramwell, F.R.S., presiding. The Directors in their report recorded a marked increase in the Company's business; about 18 miles of new mains having been laid during the year. The agreement with the Reigate Water Company has been confirmed by the East Surrey Water Act, 1896; and the Reigate undertaking came into the Company's possession on the 30th of September last. Since that date attention has been given to renovating and improving the works, plant, and machinery, and renewing the mains formerly belonging to that Company, where required. According to the provisions of the Act, £40,000 of 4 per cent. preference stock has been divided among the proprietors in the late Reigate Company, in proportion to their several holdings. The profit for the year was £9390, which, added to the balance of £908 brought forward, made £10,298, out of which the Directors placed £982 to the renewal and contingency fund; and they recommended that a dividend of 5 per cent. upon the preference and one of 6 per cent. upon the ordinary shares should be declared for the year. An interim dividend, however, of 2½ per cent. on both classes of shares, disposing of £3708, having been paid on the 2nd of December last, there remained 2½ per cent. to be paid upon the preference shares, and 3½ per cent. on the ordinary shares, which would absorb £4508, and leave a balance of £1100 to be carried forward. The Chairman moved the adoption of the report. Sir Myles Fenton seconded the motion, and it was carried unanimously, as was another agreeing to the dividends as recommended. The retiring Directors and Auditor were re-elected; and a vote of thanks was accorded to the Secretary (Mr. J. R. Downes) and the staff generally.

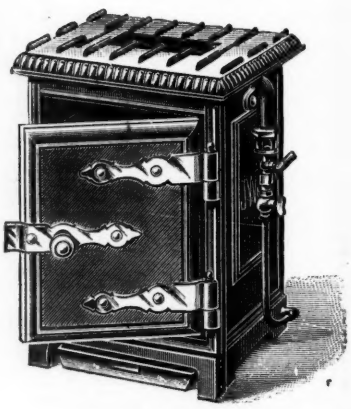
NEW "PENNY-IN-THE-SLOT" COOKERS

Arranged Specially for Prepayment Meters.

No. 402.

All Parts Rapidly and Cheaply Replaced.

Adopted by all Principal LONDON and PROVINCIAL GAS COMPANIES.



No. 401.

Nos. 403 & 404.

Very Simple and Strong.

JOHN WRIGHT & CO., LTD., BIRMINGHAM & LONDON.

The New Water-Works for Barnsley.—An event of considerable interest not only to the people of Barnsley, but to many of the populous districts outside the borough, occurred recently, when the Mayor (Alderman Wray) cut the first sod of the new water-works at Midhope, on the South Yorkshire Moors, about ten miles from Barnsley. As will be remembered, parliamentary powers were obtained for the construction of the works after a prolonged and costly fight which ended in a compromise being effected between Sheffield and Barnsley. The selected site for the reservoir is at Hogg Wood, Midhope, where a natural valley provides an admirable spot. The estimated cost will, it is believed, reach nearly a quarter of a million. Alderman Raley (the Chairman of the Water Committee), in the course of a statement respecting the undertaking, said the old Water Act was obtained in the first year of Her Majesty's reign; and he thought it was a happy augury that in the year when they were called upon to celebrate the Diamond Jubilee, the first sod should be cut of such an important undertaking. The scheme was estimated to yield about 1,670,000 gallons per day, or double the present supply. Mr. C. Hawksley, the Engineer, presented a silver-mounted spade to the Mayor.

Dissension in the Conway and Colwyn Bay Water Board.—At a meeting of the above Board a short time since, the Engineer (Mr. T. B. Farrington) presented a certificate for £2000 on behalf of the Contractors, Messrs. Sheffield and Evans, who are laying new mains through the area of the Colwyn Bay District Council to facilitate the delivery of water to Llysfaen. The question as to who should pay for these mains, the Colwyn Bay Council or the Cowlyd Board, has been in dispute, and was submitted to arbitration some time ago; the award being that the Colwyn Bay Council should pay for the portion of the mains passing through their district, other Authorities paying for other portions. The validity of the award was questioned; and several lively scenes between the Chairman (Dr. Prichard) and the Colwyn Bay members followed—the Chairman at last ruling that the award could not be discussed. Quite a series of personalities followed upon a proposal that a cheque for £2000 should be drawn on behalf of the Contractors, according to the Engineer's certificate. The Chairman held that the work, having been undertaken without the sanction of the Local Government Board, was illegal; but that, in any event, the Arbitrator appealed to by the parties concerned had ordered that Colwyn Bay should pay for their own mains. It was decided that the certificate be laid on the table.

St. Helen's Water Supply.—The Eccleston Hill water pumping-station of the St. Helen's Corporation has been extended; and a new engine and boilers have been laid down. The cost has been about £3000. The additions were formally brought into service last Thursday.

Messrs. R. & A. Main, of Glasgow, held an exhibition of gas appliances in the City Assembly Rooms, Dundee, last week, with Miss Burden as lecturer.

During the past week, Messrs. Richmond and Co., Limited, of Warrington, held an exhibition of their gas appliances in the Literary Institute, Edinburgh, with Miss Clara Lennard as lecturer.

The offices of the Kerosene Company, Limited, who are known to some of our readers as importers of oil for the manufacture of carburetted water gas, have been removed to Nos. 10 and 11, Austin Friars, E.C.

Colwall, near Malvern, is to be provided with gas. A Company has been formed to carry out this object; and the contract for the whole of the buildings and apparatus has been placed in the hands of Messrs. R. Dempster and Sons, Limited, of Elland.

The authorities of the Folkestone Town Hall have recently decided to adopt the Stott-Thorp system of lighting for the Public Hall; and they have ordered two of Messrs. J. Stott and Co.'s 3A pattern of these sunlights, of 56 jets each. The firm have also just received instructions to undertake the whole of the gas lighting arrangements for the buildings now being erected by the proprietors of the "Daily Mail" in Carmelite Street, Whitefriars. The contract covers all the piping, as well as the necessary lamps and clusters, and the gas supplies to the Linotype machines.

In connection with the exhibition of gas appliances held last week by Messrs. Richmond and Co., Limited, in the Armoury, Huddersfield, the two ladies who gave lectures on cookery—Mrs. Middleton and Miss Lillie Richmond—were each presented on Thursday evening with a gold medal, as a token of the value attached to the lectures by those who heard them. The Deputy-Mayor (Mr. Alderman Glendinning), in making the presentation, emphasized the importance of a good knowledge of cookery in households. The two ladies named have given lectures in Huddersfield on previous occasions.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65,095.

GWYNNE & CO.,
HYDRAULIC AND GAS ENGINEERS;
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. in use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON, 182, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.

Telegrams: "Volcanism, London."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

[For Illustrated Advertisement, see p. 68.]

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

120 and 121, NEWGATE STREET, LONDON, E.C.

Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE BOLTON. Special Attention to Repairs.

Before placing Orders, please write for Estimate.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.

70, CHANCERY LANE, LONDON, W.C.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND Co., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

SITUATION Wanted as Manager or Foreman, in Small Country Gas-Works. Understands the Working of every Process from Retorts to Burner. Competent to do small Repairs on the Works, Service laying, and Meter taking. Good References.
Address C. COX, Vormans Place, WEST MALLING.

WANTED, by a steady, experienced FITTER, a Situation in Gas-Works. Thoroughly experienced in Mains, Services, Slot Meters, Stoves, and General Fitting, Reading Meters, &c. First-Class Testimonials.
Address No. 2864, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

APPOINTMENT wanted by an experienced Gas Engineer, as CHIEF or ASSISTANT, or any position of trust therewith. Well up in all details of Gas Management, including Carburetted Water Gas. Good Credentials. No objection to going abroad.
Address No. 2871, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Competent Retort Setters and BRICKLAYERS.
Apply to GIBBONS BROS., LTD., DUDLEY.

WANTED, a leading Draughtsman by a Firm of Contracting Gas Engineers. Permanent situation.
Apply, stating Age, Experience, and Salary, to No. 2867, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-STOVE TRADE.

MANAGER Wanted, able to take control of men, and general oversight. Good opening for a thoroughly capable man.
Apply, stating Age, Experience, and Salary required, to No. 2872, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at a Gas-Works near London, a WAGES CLERK. Must be quick and accurate, and accustomed to keep the Wages Account at a large Works. Must be able to write Shorthand. Wages 40s. per week. Permanency. State Age and Experience, and send *copy* of Testimonial from last Employer.
Apply, by letter, to No. 2875, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Draughtsman in a Gas Engineer's Office. Capable of getting out Working Drawings for all kinds of Gas-Works Buildings and Plant. Must have had Six or Seven Years' good Experience as a Draughtsman. First-Class recent Testimonials absolutely necessary. Wages 35s. a week.
Apply, by letter, to No. 2873, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ALTRINCHAM GAS COMPANY.

WANTED, a Retort-House Foreman for Night Duty. Must be a thoroughly experienced and steady Man, and under 40 Years of Age. Wages £2 per week.
Apply, by letter, stating Age, previous Experience, and full Particulars, not later than Twelve noon, the 9th of July next.
J. E. LAMB,
Manager.
Gas Offices, Altrincham,
June 24, 1897.

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS.
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Gravelly Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

WANTED, Retort Setters and Bricklayers.
Apply to R. DEMPSTER AND SONS, LIMITED, Elland, YORKS.

WANTED, Picric Acid Foreman, thoroughly competent and capable, without assistance, of manufacturing Picric Acid in the most economical manner. Should be familiar with the most modern and improved Apparatus for the purpose.
Address P.A., care of J. W. Vickers, 5, NICHOLAS LANE, E.C.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

GASHOLDER Wanted, 35 or 40 feet diameter, Double-Lift, Columnless (Gadd and Mason's preferred); Second hand, but in good order.
Give full Particulars, Price, Age, &c., and where to be seen, to BROWN BROS. AND Co., Ltd., Rosebank Iron-Works, EDINBURGH.

STORAGE Tanks for Tar and Liquor. Several Wrought and Cast Iron ones up to 275,000 gallons capacity FOR DISPOSAL, cheap.
J. FIRTH BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE—A Station Meter complete, in thorough working order. Recently overhauled and certified correct by Messrs. Braddock. Capacity, 50,000 feet per hour.
Apply to JOHN H. DARBY, Brymbo, near WREXHAM.

FOR SALE—A Station Meter, 5-inch Connections (Milne's make).
For further Particulars and Price, apply to
A. FORRETT,
Manager.
Gas-Works, Blackwell, near Alfreton.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR IMMEDIATE SALE—Oil Plant, consisting of Three Stills, about 6 ft. 6 in. diameter by 14 ft. deep, with Pipes and Tanks, Fire-Doors, Frames, and Bars. Two TANKS, about 12 ft., 4 ft. wide, 9 ft. deep, fitted with Agitators and Shafting to work same. One HYDRAULIC PRESS and PUMP. TANKS of all sizes, Circular and Horizontal.
Apply, for full Particulars and Prices, to H. I. WILLIAMS AND Co., Kidsgrove, STAFFORDSHIRE.

FOR SALE, cheap—
One TELESCOPIC GASHOLDER, 32 ft. diameter, with two lifts 14 ft. deep each; Capacity, 22,500 cubic feet, with Wrought-Iron Tank complete.
One CAST-IRON SCRUBBER, 38 ft. 6 in. by 6 ft. diameter.
Four PURIFIERS, 12 feet square by 4 feet deep with 12-inch Valves and Connections complete.
Two PURIFIERS, 8 feet square, complete, with 6-inch Bye-Pass Valves and Connections.
EXHAUSTERS, 5000 to 60,000 cubic feet per hour.
We would undertake to re-erect any of the above, if desired.
Photos, Particulars, and Prices of above on application to SAML. WHILE AND SONS, 60, Queen Victoria Street, LONDON, E.C.

BLUE PRINTS of all kinds in any weather. Drawings and Tracings promptly executed.
J. L. FEATHERSTONE, 21, Old Queen Street, WESTMINSTER, S.W.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO GAS AND WATER OFFICIALS.

SPECIAL and Favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable Cost. "Dunlop" Tyres, Weldless Tube throughout, "Westwood" Rims, "Brook's" Saddle, "Perry's" or "Renold's" Chain, &c. The whole combining to make as fine a Machine as is possible to be made. Satisfaction guaranteed. Send at once for Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

VERY pure and faultless Thorium, with considerable Lighting Power, can be supplied regularly on very Moderate Terms.
Address J.Y. 6965, care of Rudolf Mosse, BERLIN, S.W.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of SULPHURIC ACID, and TUBES and FITTINGS.
Specification and Form of Tender may be obtained from Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their Workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the tender is sent in.
Sealed and endorsed tenders to be sent to me not later than Tuesday, July 13, 1897.
By order,
J. H. BALDWICK,
Town Clerk.
Municipal Buildings, Heywood,
July 1, 1897.

SUNDERLAND AND SOUTH SHIELDS WATER-WORKS.

THE Directors of the Sunderland and South Shields Water Company are prepared to receive TENDERS for the construction of a SERVICE RESERVOIR at Seaton Bank Top, and a SERVICE RESERVOIR and COTTAGE at Down Hill, West Boldon.
Drawings may be inspected, and Specifications and Forms of Tender and Schedules of Quantities may be obtained (on payment of Two Guineas, returnable if a *bonâ-fide* tender be made), on application at the Office of the Company, in Fawcett Street, Sunderland, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W.; on and after Friday, the 2nd day of July; and tenders must be delivered at the Office of the Company on or before Monday, the 19th day of July next.
The Company do not pledge themselves to accept the lowest or other tender.
J. W. SUTHERLAND,
Secretary.
Sunderland, June, 1897.

URBAN DISTRICT COUNCIL OF OLDBURY.
(GAS DEPARTMENT.)

THE Gas Committee of this Council are open to receive TENDERS for the supply of 9000 Tons, or thereabouts, of best screened GAS COAL, for delivery during the Year ending the 31st day of August, 1898, in such quantities and at such times as ordered, carriage free, at the (1) Oldbury Basin, G.W. Railway Company, and (2) L. & N.W. Railway Company, Oldbury.
The Coal must be of first-class quality, well screened, freshly wrought, and as free as possible from Bats, Pyrites, and all other Foreign Matter.
Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Coal," must be delivered to the undersigned not later than Saturday, July 17 next.
The Gas Committee do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.
Tender Forms and any other Information may be obtained from the undersigned, on application in writing.
By order,
A. COOKE,
General Manager.
Gas-Works, Oldbury,
July 2, 1897.

WHITSTABLE GAS COMPANY.

THE Directors are prepared to receive TENDERS for the construction of a GAS-HOLDER TANK, 62 ft. by 16 ft. 6 in., at their Works at Whitstable.

Copies of the Drawings and Specification can be obtained from the Secretary of the Company at Whitstable on payment of 10s.

The Original Drawings can be seen on application to Mr. H. E. Jones, C.E., Gas-Works, Harford Street, Stepney, London, E.

Tenders to be sent in by the 20th inst., to Mr. T. G. Browning, Secretary, marked "Tender for Tank."

TAR.

THE Directors of the Cheltenham Gas-light and Coke Company invite TENDERS for the purchase of their surplus TAR for One, Two, or Three Years, commencing on the 1st day of October next.

Estimated Quantity, 2000 Tons per Year.

Tenders to state Price per Ton free on Rails at Cheltenham.

The Directors do not bind themselves to accept the highest or any tender.

R. O. Paterson,
Manager.

Gas-Works, Cheltenham,
July 3, 1897.

SURPLUS TAR.

THE Gas Committee of the Corporation of Coventry are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works, Coventry, for One Year from July 1, 1897.

Make about 2000 Tons per annum.

Tenders, stating price per ton delivered into Boat, to be addressed to the Manager, and marked "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

Geo. Winstanley, Assoc.M.Inst.C.E.,
Manager.

Gas-Works, Coventry,
July 1, 1897.

GAS COAL.

THE Bethesda Urban District Council are prepared to receive TENDERS for the GAS COAL required at their Gas-Works during the ensuing Year, in such quantities and at such times as may be required (in all about 300 Tons), from the 1st of August, 1897, to the 31st of July, 1898.

The person whose tender is accepted will be required to enter into an agreement with the Council for the due performance of his contract.

The lowest or any tender not necessarily accepted.

Tenders to be sent to me on or before the 17th inst.

R. Benjamin Evans,
Clerk.

Bron Arfon, Llanllechid,
near Bangor, July 3, 1897.

STOURBRIDGE GAS-WORKS.

TENDERS FOR GAS COAL.

THE Gas Committee of the Urban District Council of Stourbridge invite TENDERS for the supply of 10,000 Tons of GAS COAL, for delivery over the Year ending June 30, 1898.

Forms of Tender may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Gas Coal," to be addressed to the Chairman of the Gas Committee, and delivered to the undersigned on or before July 12, 1897.

By order,
Wm. North,
Engineer and Manager.

Gas-Works, Stourbridge,
June 19, 1897.

WALLINGFORD GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR GAS COAL.

THE Wallingford Gaslight and Coke Company, Limited, invite TENDERS for the supply for One Year, from the 13th of August next, of about 900 Tons of best screened GAS COAL, to be delivered free, at the Railway Station at Wallingford, in such quantities and at such times as the Company may require.

Payments monthly.

Sealed tenders, endorsed "Tender for Gas Coal," to be delivered on or before the 31st of July next.

The Company do not bind themselves to accept the lowest or any tender.

By order,
John Carthew,
Secretary.

Wallingford, June 30, 1897.

OLDHAM CORPORATION WATER-WORKS.

ROODEN RESERVOIR—IRONWORK, VALVES, &c.

THE Water-Works Committee are prepared to receive TENDERS for the supply of IRONWORK, VALVES, &c., required in the construction of this Reservoir.

The Specification and Forms of Tender may be obtained and Drawings may be seen at the Offices of Messrs. G. H. Hill and Sons, 3, Victoria Street, Westminster, and Albert Chambers, Albert Square, Manchester, on payment of one guinea.

Sealed tenders, endorsed "Tender for Ironwork, Valves, &c.," must be addressed to Mr. Arthur Andrew, Water-Works Offices, Oldham, on or before Tuesday, July 13, 1897.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
A. Nicholson,
Town Clerk.

Town Hall, Oldham,
June 16, 1897.

MANUFACTURE AND SUPPLY OF GAS AT SANDHURST.

THE Secretary of State for War is prepared to receive TENDERS for the MANUFACTURE and SUPPLY OF GAS at Sandhurst, during a period of Six Years from the 1st of August, 1897.

The existing Gas-Works at Sandhurst may be inspected, and Printed Forms of Tender, and any further Information obtained, on application to the Assistant Adjutant General, Aldershot.

The Tenders are to be delivered at the Head-Quarter Office, South Camp, Aldershot, by Twelve o'clock Noon, on Wednesday, the 7th day of July, 1897, addressed to the General Officer Commanding, and marked on the outside "Tender for Manufacture of Gas."

A. Major,
Director of Army Contracts.

War Office, Pall Mall, S.W.,
June, 1897.

STAINES RESERVOIRS JOINT COMMITTEE,

Incorporated by Act of Parliament,
59 and 60 Vict., cap. 241.

ISSUE OF £250,000 £3 PER CENT. DEBENTURE STOCK.

Payment of Interest guaranteed by the three following Companies:—
The West Middlesex Water-Works Company,
The Grand Junction Water-Works Company, and
The New River Company,
jointly and severally.

NOTICE is Hereby Given, that the Joint Committee are prepared to receive TENDERS for the above ISSUE, being the first portion of the DEBENTURE STOCK created by the above Act, bearing Interest at 3 per cent. per annum, payable half yearly, and redeemable after the expiration of 25 Years from the date of issue, subject to Six Months' notice being given by the Committee.

Tenders must be delivered at the Office of the Committee, No. 19, Marylebone Road, N.W., not later than Two o'clock p.m., on Wednesday, the 21st July next.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Office, or will be forwarded upon application; also of Messrs. Hollams, Sons, Coward, and Hawksley, Solicitors, 30, Mincing Lane, E.C.; and of Messrs. Prescott, Dimsdale, and Co., Limited, Bankers, 50, Cornhill, E.C.

By order of the Joint Committee,
F. H. Wythoo,
Secretary.

Office of the Committee:
19, Marylebone Road,
London, N.W., June 16, 1897.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883—1888.

NOTICE is Hereby Given, that Michael CROWLEY, of 14, College Green, Dublin, has APPLIED FOR LEAVE TO AMEND THE SPECIFICATION of the Letters Patent No. 17,644 of 1896, granted to Robert Goodwin, for "A Gas Plant and System to Make and Produce Acetylene Gas or Acetylene and Carbonic Acid Gas combined."

Particulars of the proposed Amendments were set forth in the "Illustrated Official Journal (Patents)" issued on the 30th of June, 1897.

Any Person or Persons may give notice of opposition to the Amendment (on Form G) at the Patent Office, 25, Southampton Buildings, London, W.C., within One Calendar Month from the date of the said "Journal."

(Signed) C. N. Dalton,
Comptroller General.

Abel and Imray,
Consulting Engineers and Chartered Patent Agents,
28, Southampton Buildings, London, W.C.,
Agents for the Applicant.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

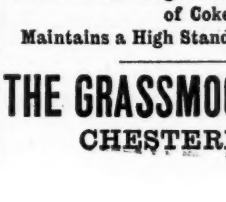
MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, Finsbury Circus, E.C.

PRICE'S COKE & COAL BARROW



effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. Edward Price, 119, Queen's Road, Finsbury Park, N.

Prices are Reduced.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke. Maintains a High Standard in Residuals.

THE GRASSMOOR CO., Ld.,
CHESTERFIELD.

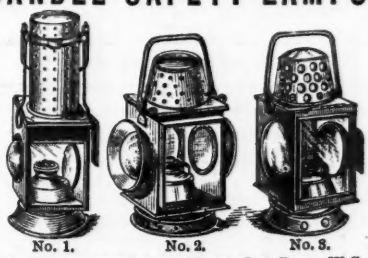
E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

THE "COOMBE" DRAUGHT SCREEN FOR INCANDESCENT BURNERS.

For Illustration and Statement of Advantages to be gained by its use, see "Journal," June 1, p. 1271.

ALFRED ARCULUS & CO., Glass Manufacturers,
BIRMINGHAM.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.

43, Manchester Street, Gray's Inn Road, W.C.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
and
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

Latest Analysis—By Charles Phillips, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 1/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

Results of Different Analyses:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad St., E.C.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

HUNTER'S

OXIDE OF IRON.

James Hunter, Miner and Shipper of

NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "Hunter, Port Glasgow."

Established 1872.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE."

THOMAS TURTON AND SONS, Limited,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

WATERBLEAN PAINT

Telegrams:

"EVESON, BIRMINGHAM."

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

8 Lombard Street,

NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

For Prices and Particulars, apply to

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500	Cub. Ft.
Illuminating Power . .	16·9	Candles.
Coke (of good quality) . .	67·5	per Cent.
Sulphur	0·58	„
Ash	2·73	„

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

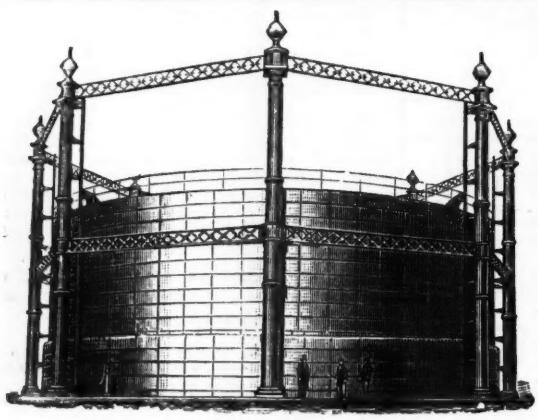
THOS. W. DANCE & SONS,

Coal Owners, Newcastle-on-Tyne;

or

E. FOSTER & CO.,

21, John Street, Adelphi, London, W.C.



PORTER & CO.,

GAS ENGINEERS,

MANUFACTURERS, IRONFOUNDERS, & CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

Telegraphic Address: "PORTER LINCOLN." National Telephone, No. 13.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

References to 600 Works already erected.

N.B.—All Communications to be addressed to the FIRM ONLY.

PENNY-IN-THE-SLOT GAS-METERS,

SHILLING-IN-THE-SLOT METERS.

Every Description of ORDINARY GAS-METERS.

THE AUTOMATIC

GAS-METER (1895) CORPORATION, LTD.

ROCK METER WORKS,

TORTWORTH STREET, STRANGEWAYS, MANCHESTER.

London Address: 59, QUEEN VICTORIA STREET, E.C.

HUTCHINSON BROTHERS,

GAS ENGINEERS, &c.,

MANUFACTURERS OF

Improved Wet & Dry Gas-Meters.

STATION-METERS. LAMP-METERS.

Test Gasholders and General Gas Apparatus.

Brass Main & Lamp Taps. Unions, Ferrules, &c.

The "Falcon" Lamplighter's Torch. Service Cleansers.

SYPHON AND OTHER PUMPS.

WOOD AND WROUGHT-IRON PURIFIER-GRIDS. SCRUBBER BOARDS.

WET AND DRY METERS REPAIRED.

FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

LONDON OFFICE
60, QUEEN VICTORIA ST. E.C.

TELEGRAPHIC ADDRESSES
"DRAKESON HALIFAX."
"ECLAIRAGE LONDON."

TELEPHONE No 43.
"HALIFAX EXCHANGE"

GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.

JONAS DRAKE & SON

SOLE AGENTS FOR

HISLOP'S

PATENT REGENERATIVE FURNACES

— FOR —

ENGLAND, WALES & ABROAD.

RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES. RESULTS GUARANTEED.

OVENDEN HALIFAX

RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.

Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

ARROL-FOULIS
PATENT HYDRAULIC MACHINERY
FOR
CHARGING AND DRAWING GAS-RETORTS

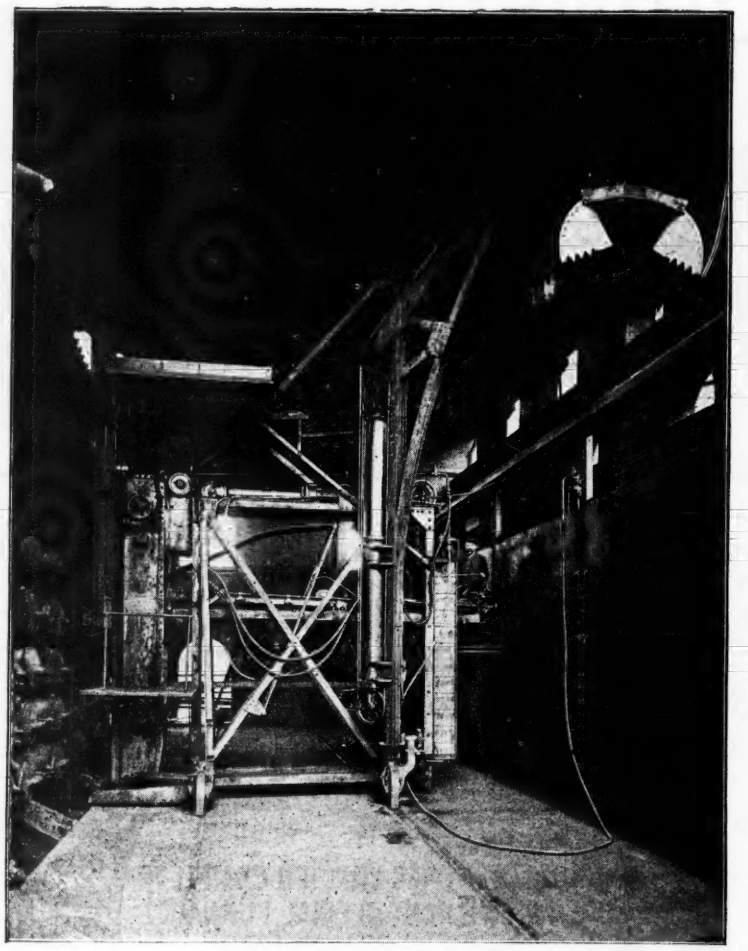
SIR WILLIAM ARROL & CO., Ltd., Sole Makers,
DALMARNOCK IRON-WORKS, BRIDGETON,
GLASGOW.

LONDON ADDRESS: 32, VICTORIA STREET, WESTMINSTER, S.W.

PLANS AND ESTIMATES FURNISHED ON APPLICATION.

THE
ARROL-FOULIS
MACHINES
Are Employed at the following Works—

GLASGOW GAS-WORKS—
Tradeston.
Dawsholm.
Dalmarnock.
GASLIGHT & COKE COMPANY—
Beckton.
SOUTH METROPOLITAN GAS COMPANY—
East Greenwich
Vauxhall.
Rotherhithe.
COMMERCIAL GAS-WORKS—
Wapping.
Poplar.
BROMLEY GAS-WORKS (KENT).
EDINBURGH GAS-WORKS.
LIVERPOOL GAS-WORKS.



WAPPING GAS-WORKS.

THE
ARROL-FOULIS
MACHINES
Are Employed at the following Works—

LEEDS GAS-WORKS.
BIRMINGHAM GAS-WORKS.
BRITISH GAS CO.—
Hull.
BOLTON GAS-WORKS.
IMPERIAL CONTINENTAL GAS ASSOCIATION—
Amsterdam.
Vienna.
HAGUE CORPORATION GAS-WORKS—
Hague.
METROPOLITAN GAS-WORKS—
Melbourne.
CLEVELAND GAS-WORKS—
Cleveland, Ohio,
&c., &c., &c.

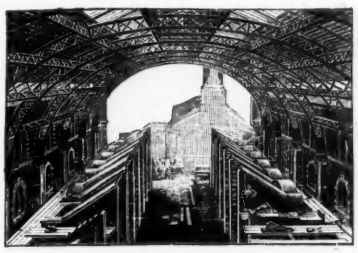
OVER 200 MACHINES ARE AT WORK OR IN COURSE OF CONSTRUCTION.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

ONE MINUTE.

W. C. HOLMES & CO.

IRONFOUNDERS AND CONTRACTORS.

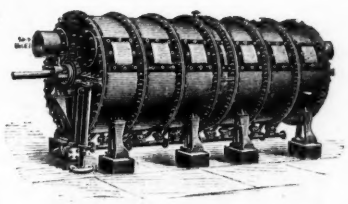


Makers of
GAS & CHEMICAL
PLANT.

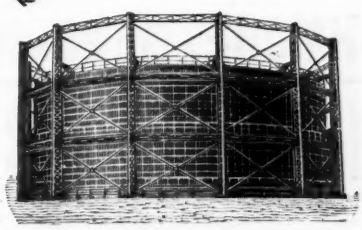
Telegrams:
"HOLMES, HUDDERSFIELD."

Improved
PATENT SCRUBBER-WASHERS,
All sizes,
From 50,000 to 5,000,000 Cubic Feet of Gas per day.
Results unrivalled. Send for Particulars and Prices.

MALLEABLE
and all Kinds of
CASTINGS.



GASHOLDERS of Improved Construction and of all Sizes.
ROOFS, BRIDGES, TANKS, GIRDERS.



Improved
BYE-PASS and
CENTRE-VALVES,
GOVERNORS,
and METERS.

Rotary or Pump
EXHAUSTERS.

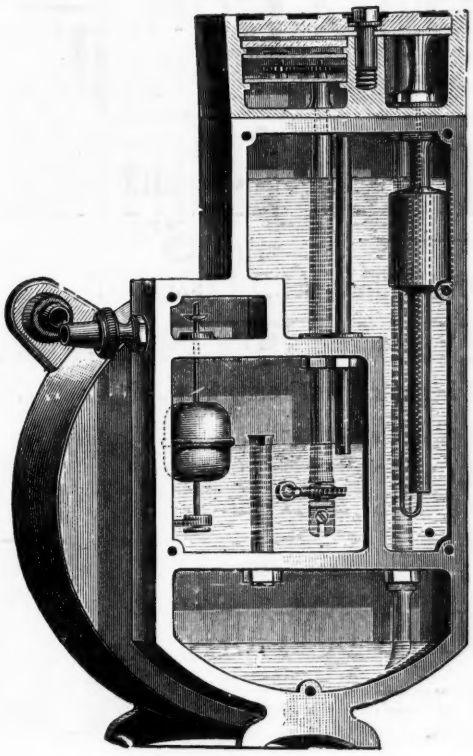
80, CANNON STREET, LONDON,
AND
WHITESTONE IRON WORKS, HUDDERSFIELD.

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



Sole Makers of Green's Patent Underground Wet Gas-Meters for Street Lighting, &c., and Ogden's Patent Spindle Tube for Wet Gas-Meters.

GREEN'S PATENT
UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required; and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s.; and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

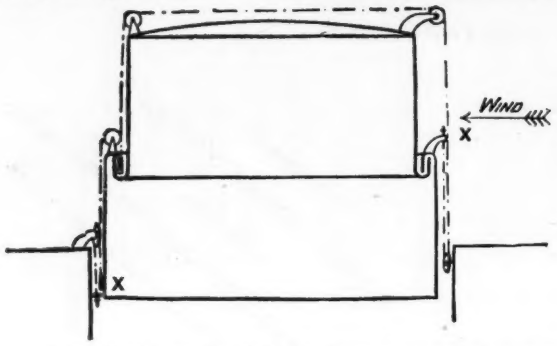
Prices and all Information on Application.

NEW GRANGE WORKS, EDINBURGH.

HIGHEST AWARDS given for our WET and DRY METERS at

Exhibitions held at GLASGOW, CALCUTTA, and EDINBURGH.

THE CABLE SYSTEM THE SIMPLEST GASHOLDER SUPPORT.



ONE ¾-inch Steel Cable in Double Purchase has a controlling power of **60 TONS**

WIND at 30 lbs. per foot has an overturning power of less than **9 TONS**
in the case of a Holder of Two Lifts, 100 ft. by 20 ft.

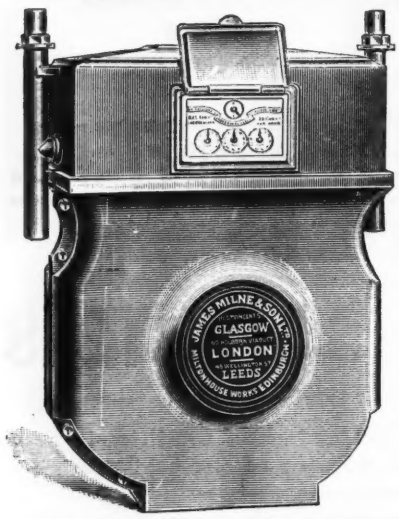
A Gasholder on the Cable System can rely on a support which is exactly known in amount, is direct and simple in application, and is exerted through the strongest parts of the framework only.

A list will be published next week of some of the 52 Cable Holders erected or on order.

N.B.—If the holder were always at one height, the Cables might be fastened at XX. *The support that the Holder derives from the Cables is equally perfect, notwithstanding its rise and fall.*

ASHMORE, BENSON, PEASE, & CO., LTD., STOCKTON-ON-TEES.

MILNE'S PATENT COMPOSITE DRY GAS-METER



THE WORKING PARTS OF A TIN-CASE DRY METER ENCLOSED IN A TWO-PART IRON-CASE.

THIS Meter combines all the advantages of the Dry Gas-Meter with the strength and durability of the Wet Meter. It consists of Cast-Iron Cases front and back enclosing the bellows, and screwed to each other with the Division-Plate between; while the upper portion containing the Valve Chambers and Index is made of extra thick Tinned Iron—the Side Tubes being made of brass, with suitable provision for Trapping any Condensation.

It is well known that the only parts of an ordinary Tin-Case Dry Meter which are attacked by outside Corrosion are the bottom and the lower parts of the Sides, and also the Side Tubes. In this Composite Meter, these parts are made either of Cast Iron or Brass, and thus rapid deterioration is prevented, and the weight is not unduly increased.

JAMES MILNE & SON, LTD.,

GAS ENGINEERS, Milton House Works, EDINBURGH,

LONDON. GLASGOW. LEEDS.

INCANDESCENT STREET LIGHTING.

THE ONLY SUCCESSFUL, ECONOMICAL, AND EFFICIENT

ANTI-VIBRATION SYSTEM.

Every Gas Engineer, Gas Manager, and Lighting Authority should adopt it.

Applicable to existing Lamps.

THE LARGEST INSTALLATION OF INCANDESCENT STREET LIGHTING IN ANY BRITISH TOWN IS ON THIS SYSTEM.

SUCCESSFUL RESULTS GUARANTEED IN ALL SITUATIONS.

Full Particulars on Application to

THE ANTI-VIBRATION INCANDESCENT LIGHTING COMPANY, Limited,

12 & 14, WESTGATE ARCADE, BRADFORD, YORKS.

WE HOLD THE ORIGINAL PATENTS.

JOHN BROWN & CO., LTD., SHEFFIELD.

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

DIAMOND JUBILEE

OF

CLAPHAM BROTHERS, LD.,

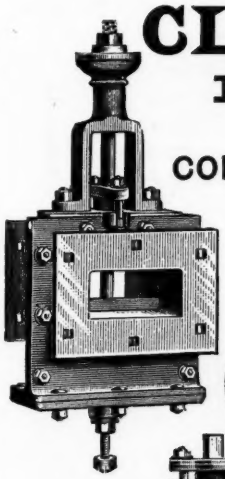
KEIGHLEY, YORKS.

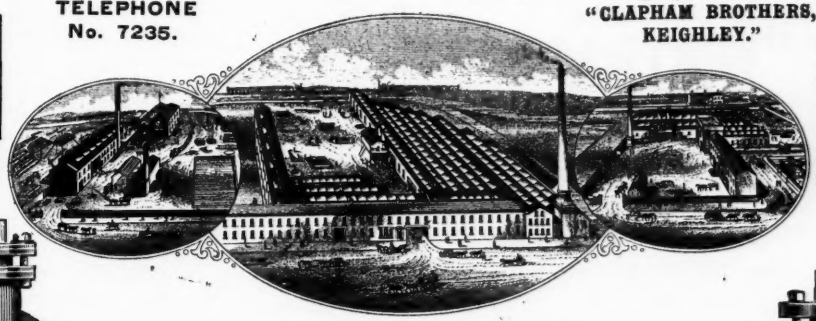
— ESTABLISHED 1837 —

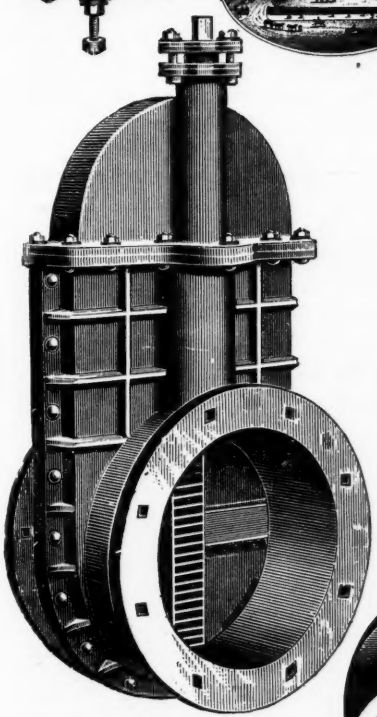
CONTRACTORS TO HER MAJESTY'S GOVERNMENT.

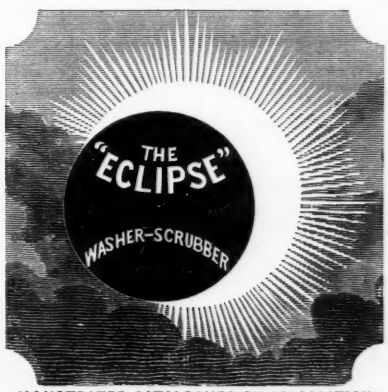
TELEPHONE No. 7235.

Telegraphic Address: "CLAPHAM BROTHERS, KEIGHLEY."

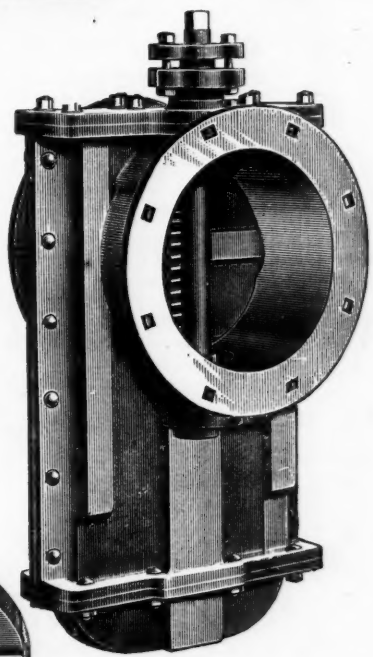


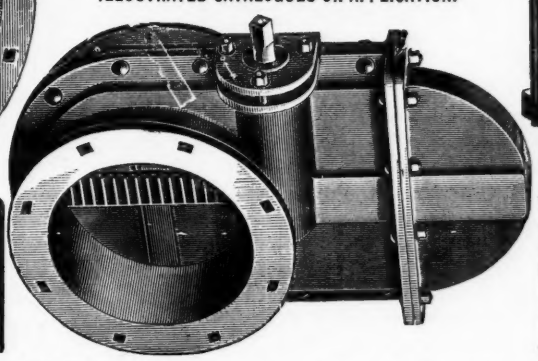






ILLUSTRATED CATALOGUES ON APPLICATION.





GASHOLDER TANKS, COLUMNS, GIRDERS, LAMP-POSTS, GUTTERS.

RETORT-FITTINGS, PATENT CONDENSER, PURIFIERS, WITH PLANED JOINTS.

WATER VALVES & MAINS, and all kinds of Gas-Making Apparatus and General Ironwork.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.

Established 1860.

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1826.

OSLER,
BIRMINGHAM.
MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-Candle Power
PLAIN IRON LAMP,
CLASS A— **55/-**
LIGHT for LIGHT
less than half the price of any other Regenerative Lamp.
Manufactured in England.

HENRY GREENE & SONS,
153 & 155, CANNON STREET,
LONDON BRIDGE, E.C.
PARTICULARS AND PRICES FREE. AGENTS WANTED.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON OFFICES & DEPÔTS:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

THOMAS BUGDEN,
Manufacturer of
Gas Bags for Mains, High Water-Boots, Miners' Woollen Jackets, Delivery and Suction Hose, Leather Machine Bands, Diving and Wading Dresses, Waterproof Coats and Capes of every description, Iron Wheels and Rollers covered with India-rubber, Rubber Bags for Testing Drains. Stokers' Mitts, from 14s. per dozen.

Gas-Bags for Mains.

Miners' Woollen Jackets.

High Water-Boots.

71, GOSWELL ROAD, LONDON, E.C.

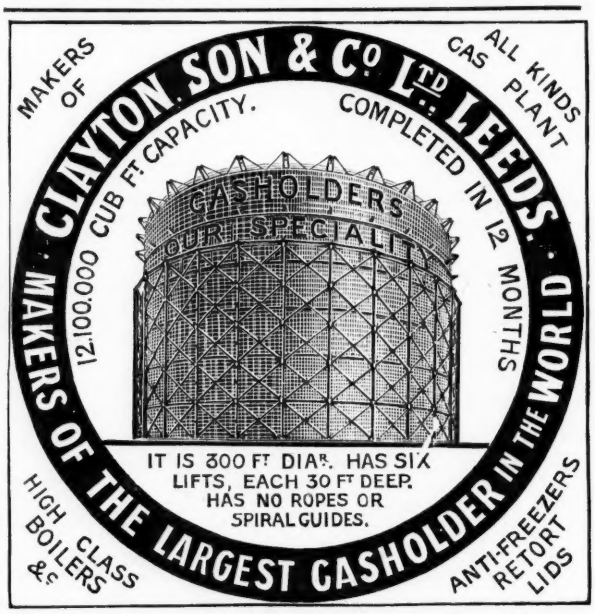
PATENT TWISTED TAPER RYMERS & TAPS.

These **Patent Twisted Taper Rymers and Taps** are the best ever made for Gas and Water Service Connections. A true Hole and a correct Thread can be assured. They are easy to work, and will last much longer than straight grooved Taps and Rymers.

THOUSANDS ARE IN DAILY USE.

Also SCREWING-MACHINES, STOCKS and DIES (with Patent Twisted Dies), PIPE-TONGS, and other TOOLS.

Apply for Prices and Particulars to
JOHN RUSCOE,
ALBION WORKS, HYDE, near MANCHESTER.


MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
COMPLETED IN 12 MONTHS
12,100,000 CUB FT CAPACITY.
GASHOLDERS OUR SPECIALITY
IT IS 300 FT DIAS. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

London Office: 60, QUEEN VICTORIA, STREET, E.C.
Telegraphic Addresses: "GAS, LEEDS," "ECLARAGE, LONDON."

OXIDE OF IRON.

NATURAL BOG ORE FROM OWN MINES.

Samples and Prices on application.

Wm. H. MÜLLER & CO.,

81, PALMERSTON BUILDINGS, LONDON, E.C.

TRADE MARK: "Compascum." Telegraphic Address: "FERRUM."

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS,

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (FOUR APPARATUS).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

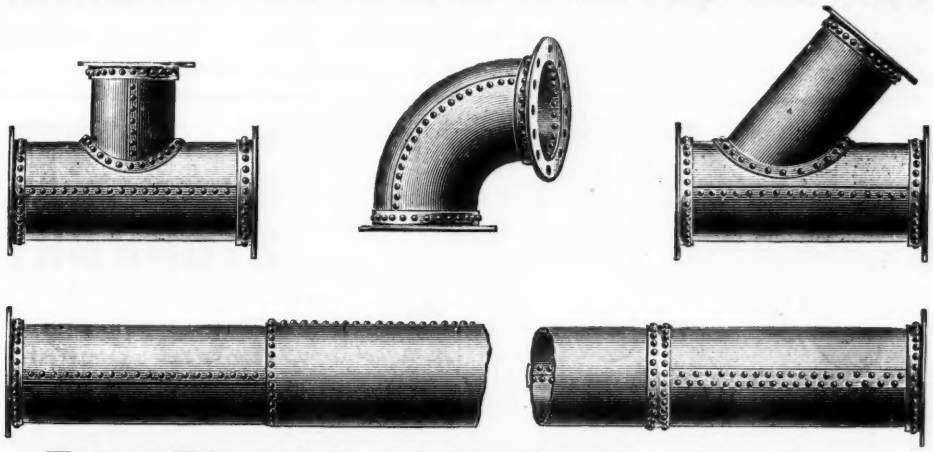
R. & J. DEMPSTER, LTD., GAS PLANT WORKS,

Telegraphic Address: "SCRUBBER, MANCHESTER." National Telephone Nos. 54 and 2296.

NEWTON HEATH, MANCHESTER.

RIVETTED OR WELDED TUBES

OF ANY DIAMETER AND STRENGTH IN WROUGHT IRON OR STEEL.



Tubes Rivetted and Caulked by Machinery.

Suitable for GAS-MAINS, FOUL-MAINS, HOT-AIR MAINS, BLAST-MAINS, WATER-MAINS, &c.

For Transport—Economical. For Large Spans—Useful. For Condensing—Effective. For Districts where Land Subsidences are frequent.

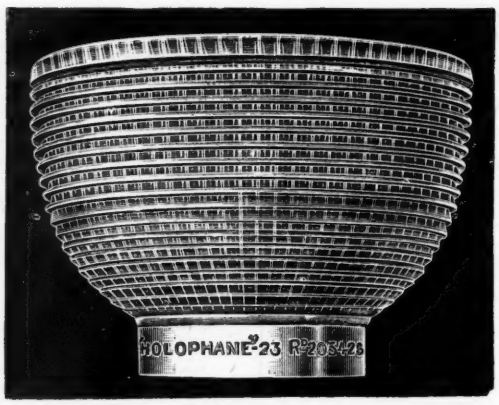
London Office: **181, Gresham House, Old Broad Street, E.C.**

"HOLOPHANE"

PATENT LIGHT-DIFFUSING GLOBE.

Guaranteed to give more Light, with better Diffusion, than any Globe in existence.

LATEST PATTERN No. 23.



No. 23. NEW EYECUP for "C" Incandescent Burner.
Diameter 5 inches. Height 3½ inches.

IN CRYSTAL 24s. PER DOZEN. IN NEW PATENT ROSE TINT 36s. PER DOZEN.

SPECIAL PATTERNS FOR ARC, INCANDESCENT GAS "C" BURNERS, AND OIL-LAMPS.

Dr. DREHSCHMIDT, of Berlin, has recently made exhaustive tests with the latest "Holophane" Patent Light-Diffusing Globes, when used with Incandescent Gas-Burners, and has proved conclusively that, below the horizontal, the "Holophane" gives an average of 29 per cent. more light than the bare Incandescent Burner; and at angles below 45°

OVER **100** PER CENT. MORE THAN THE BARE LIGHT.

PRICES FROM 2s. *Illustrated Catalogue Free.*

"HOLOPHANE" LTD., 91, 93, 95, QUEEN VICTORIA STREET, LONDON, E.C.

G. & J. HAIGH,

Raven's Lodge Fire-Brick Works, DEWSBURY.

FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character, suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**

WHITE GLAZED AND SALT GLAZED BRICKS, BUFF FACING BRICKS, &c.

For Prices and Analysis, apply as above.

MOBBERLEY & PERRY
STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c. &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

BALE & HARDY, Gas Engineers and Contractors, BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 6, 1897.